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# AERONAUTICAL ENGINEERING REVIEW

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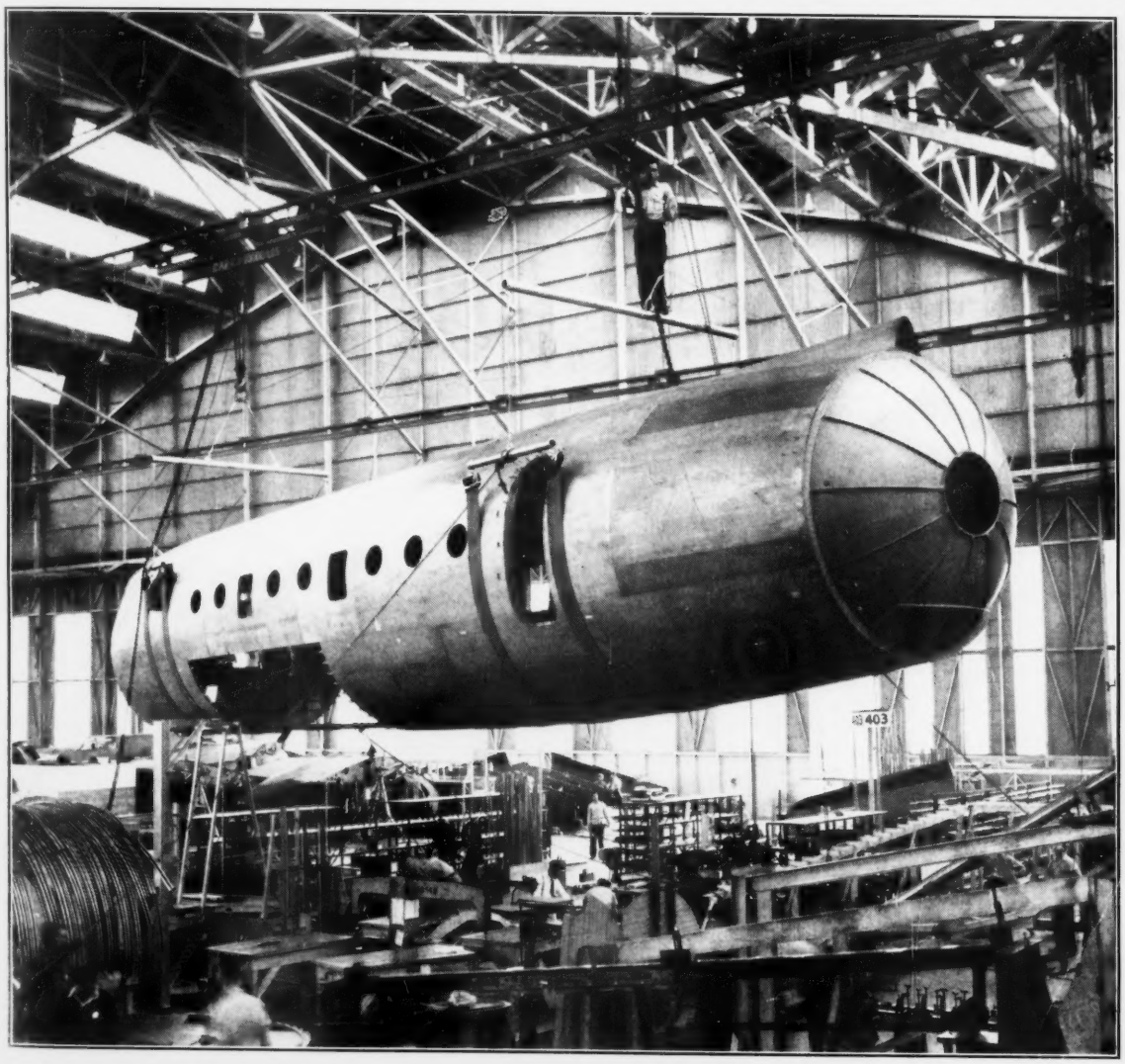

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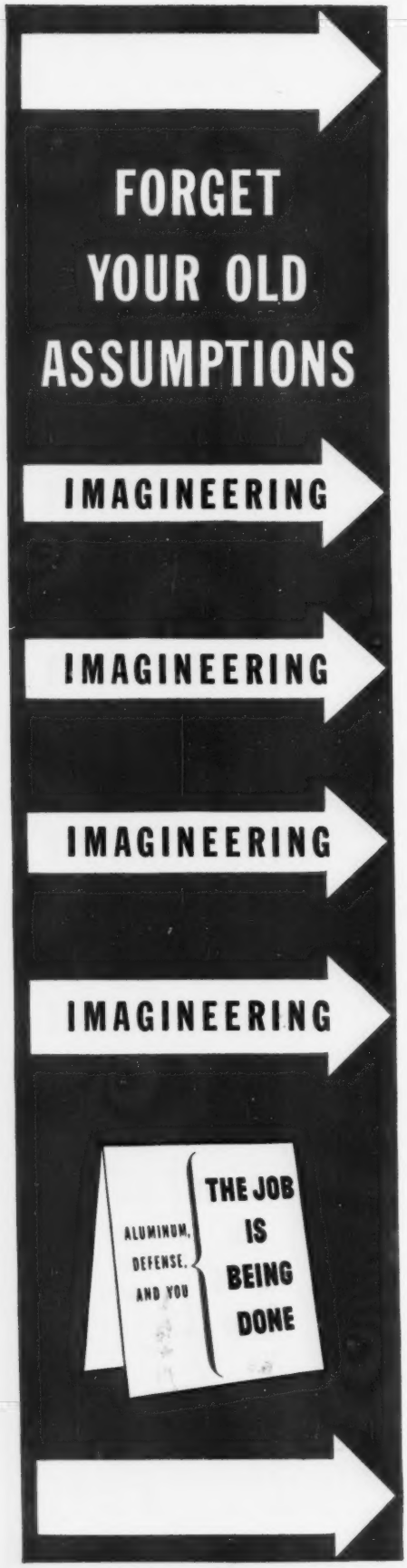


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***IN THESE DAYS*** an advertisement is no place either for hosannas or sermons about production. Every man knows how well he is doing the job that is before him. Deeds, not words, are the measure.

***BUT WORDS CAN BECKON*** beyond the realms of immediate duty.

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Aluminum Company of America, 2142 Gulf Building, Pittsburgh, Pennsylvania.

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# AERONAUTICAL ENGINEERING REVIEW

**VOLUME 1** **APRIL, 1942** **NUMBER 1**

*Successor to the Aeronautical Review Section and Edition of the Journal of the Aeronautical Sciences*

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*Statements and opinions advanced in the Aeronautical Engineering Review are to be understood as individual expressions and not those of the Institute.*

George R. Forman, *Editor* Robert R. Dexter, *Managing Editor* Bennett Horchler, *Manager*

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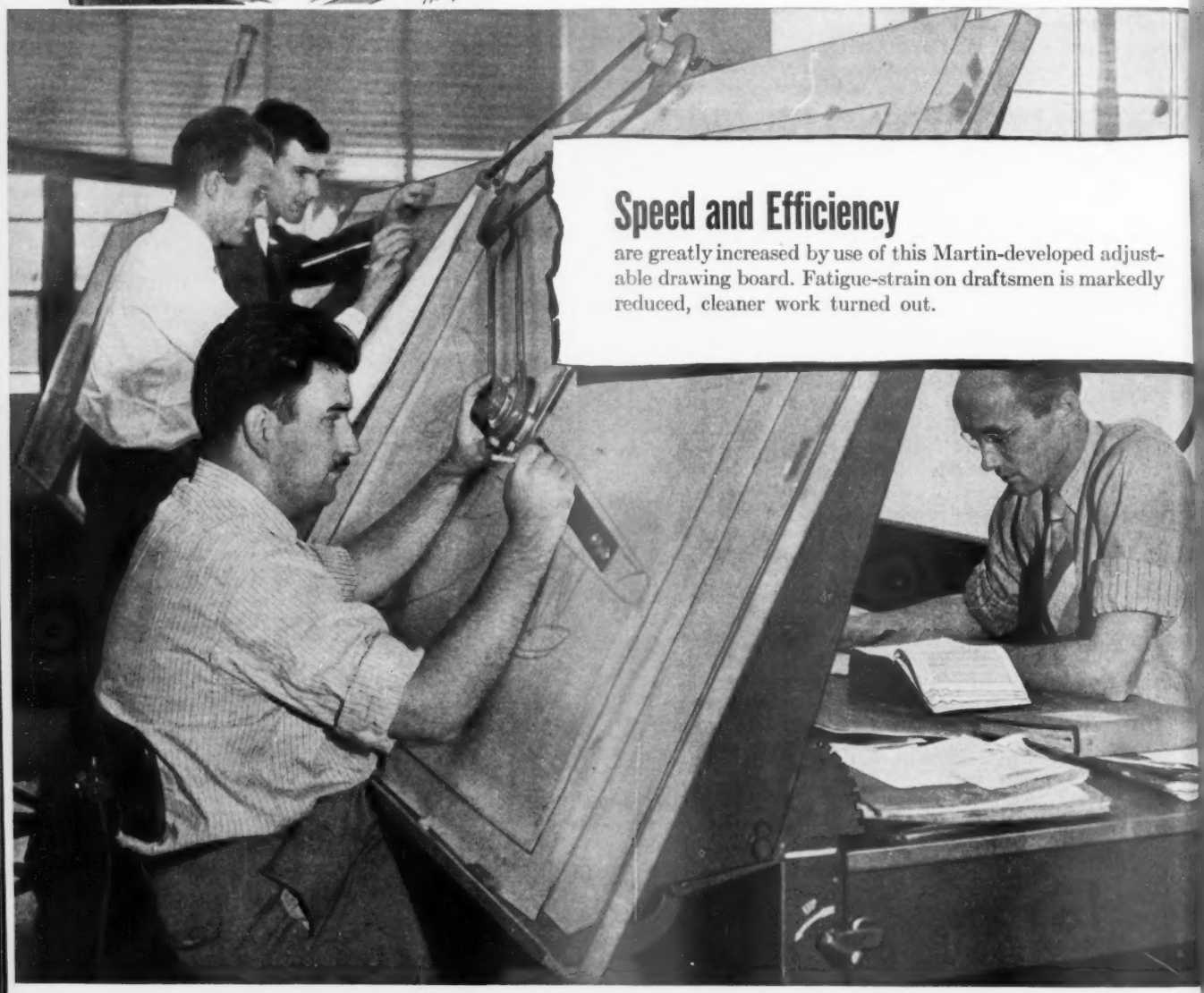
was the order of the day for engineers and draftsmen using old-style, flat drawing boards. Perspiration and pencil dust hampered output.



## Speed and Efficiency

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# Less "Back-break" Per Bomber

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These adjustable drawing boards are merely another step in the Martin drive for redoubled efficiency and speed. Every hour saved, every increase in production, is a vital factor in speeding Victory.

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# AERONAUTICAL ENGINEERING REVIEW

## On Our Own

With this issue, the *Aeronautical Review* section of the *Journal of the Aeronautical Sciences* becomes a separate publication to be known as the *Aeronautical Engineering Review*. Just as the section was the outgrowth and expansion of the engineering reviews in the *Journal*, the *Review* will be an expanded version of the publication that has served the aeronautical profession so well since 1940.

Gradually, technical articles in the fields of applied engineering and aircraft production will be added to the *Review's* sections so that the *Aeronautical Engineering Review* will render an added service to members of the Institute by giving them the kind of articles which, because of limitations of size and policy have not been available for publication in the *Journal*.

The editorial content of the *Journal* will remain the same as it always has been. Within the limitations of the present war conditions, it will continue to print technical papers on advances in the aeronautical sciences.

## Our New Stamp

Recipients of mail from the Institute of the Aeronautical Sciences will observe the distinctive new postage meter stamp appearing on all of our envelopes. In its design we have endeavored to crystallize the objectives of present-day aeronautical research into a single small illustration and a few words occupying a space of less than one and one-half square inches.

Showing a head-on view of an idealized twin-engine fighter, the delineation bears the legend

SPEEDING VICTORY

**WITH AMERICAN RESEARCH-DESIGN-PRODUCTION**

Current history has established the fact that the first line of victory is the drafting board, the wind tunnel, and the powered production line. The unsung architects of victory are those who man these unheralded firing lines. Thus, we pledge a silent toast to the production soldiers of the aeronautical industries.

## Bibliography of Aeronautics

The increase in the number of aeronautical libraries is one of the natural results of the expansion of the aircraft industry and the need by newcomers to the aeronautical profession for books to be used with their tools.

Inasmuch as there are few trained aeronautical librarians and new libraries will have to be supervised by persons unfamiliar with the extent of the bibliography of aeronautics, the Aeronautical Archives of the Institute is preparing a pamphlet that will give a concise summary of the scope of the bibliography of aeronautics. It will be submitted as a paper before the American Bibliographical Society in June and will be available for distribution at that time.

## Keeping the Channels Open

Keeping the trade name of a product or service before the public even when that product or service must be suspended for the duration of war means the preservation of that business or industry when peace comes. This was one of the costly lessons taught by the last World War.

Firms are today making every effort to maintain their place in the consumer's world by continuing to advertise not only when the volume of business makes advertising seemingly unnecessary but also when the product or the service advertised cannot even be supplied.

Experience has shown that gargantuan growth of industry in wartime can prove to be a boomerang unless provision is made for productive capacity to be put to work usefully after the emergency. The contraction of public relations programs occurring in many wartime industries should inspire a serious examination by industrialists of the postwar future and the necessity for keeping up an unrelenting advertising campaign during the war in order to assure that postwar future and to have the nation "sold" in advance.

# ADVANCED TRAINERS

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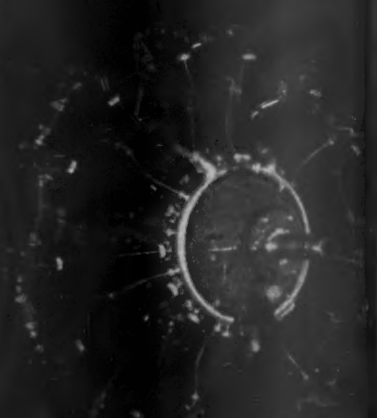
CESSNA AT-17

# JACOBS *Engines*



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FOR THE UNITED NATIONS

## JACOBS AIRCRAFT ENGINE CO.

POTTSTOWN, PENNSYLVANIA, U.S.A. — CABLES, JAECO

# News Review

**February 10.** The Civil Aeronautics Board granted American Export Airlines a temporary certificate authorizing the company to operate passenger and mail service between New York and Foynes, Ireland.

**February 11.** The War Production Board ruled that preference rating assistance, granted for the repair and maintenance of aircraft and equipment, may be used to obtain ground radios, tools, and essential-type office machinery, as well as materials physically incorporated into the airplane.

**February 12.** Japanese long-range four-engined flying boats bombed the Solomon Islands.

**February 13.** The Navy Department announced a successful raid by sea and carrier-borne air units on the Japanese bases on the Gilbert and Marshall islands.

**February 14.** Japanese parachute troops were dropped from an air convoy of more than 100 airplanes in Sumatra. A large number of these were killed by the defenders before landing.

**February 14.** Douglas Aircraft Company, Inc., delivered the first C-54 troop transport to the Army. Developed from the DC-4 transport the new troop carrier is powered by four 1,350 hp. Pratt and Whitney twin-row Wasp engines.

**February 16.** The House Appropriations Committee approved a bill for the maintenance of the departments of State, Commerce, and Justice. This includes a $36,000,000 fund for the expansion of civilian pilot training.

**February 17.** A major artillery and air drive was launched by the Japanese against General MacArthur's forces on the Bataan Peninsula. The same Army communique announced that U.S. Flying Fortresses attacking Japanese shipping sank two enemy transports between Sumatra and Borneo.

**February 17.** Donald M. Nelson, Chairman of the War Production Board gave aircraft manufacturers an A-1-a priority rating, placing them on a par with tank and ship production. Nelson overruled the Army-Navy Munitions Board which placed airplane priorities on a slightly lower basis than light tanks and surface vessels scheduled for completion this year.

**February 17.** Under a new order issued by the War Production Board light aircraft may be sold only to a specific group of buyers, largely the armed services.

**February 18.** A heavy Japanese air attack was reported on Darwin on the north Australian coast.

**February 18.** The crew of a Japanese seaplane occupied the capital of the Solomon Islands.

**February 18.** The Distinguished Flying Cross was awarded to Col. Caleb V. Haynes of the Air Corps Ferry Command and five other officers and men comprising the crew of a B-24 for their 26,000 mile flight recently made to survey fields and facilities in Africa and Asia Minor.

**February 19.** Air Marshal Arthur T. Harris, head of the Royal Air Force delegation in Washington, was appointed Commander-in-Chief of the Bomber Command, succeeding Air Marshal Sir Richard E. C. Peirse. Harris will be replaced by Air Vice-Marshal D. C. S. Evill.

**February 21.** The War Department announced that the commercial airlines of the nation had agreed to turn over 25 transports to the Army Air Force.

**February 23.** Maj. August von Parseval, pioneer builder of non-rigid aircraft and designer of the "drachen" type observation balloon, died in Berlin at the age of 81.

**February 23.** In a general shift of the British War Cabinet Lt. Col. J. T. C. Moore-Brabazon was replaced by Col. J. J. Llewellin as Minister of Aircraft Production.

**February 24.** The Wright Aeronautical Corporation signed an agreement with the government of Brazil whereby Whirlwind type engines will be built in a government-sponsored plant near Rio de Janeiro.

**February 26.** Lieut. Col. Stedman S. Hanks of the Army Air Corps announced the completion of a survey for a nation-wide system of flight strips designed to act as dispersion bases. This statement was made in a speech before the Association of Highway Officials meeting in Philadelphia.

**February 27.** Lockheed Aircraft Corp. displayed a "mock-up" of the 57 passenger four-engined Constellation being built with Army approval for Transcontinental & Western Air.

**March 2.** A simplified Army command, creating three general departments—ground forces, air, and supply—was ordered by President Roosevelt. This action creates a virtually autonomous air arm under General H. H. Arnold.

**March 3.** Sixteen Japanese bombers were shot down by Naval pilots in an attack on the Pacific Fleet carrier squadron near the Gilbert Islands. Lieut. Edward H. O'Hare accounted for six of these with one single-seater fighter.

**March 3.** The small U.S. air force fighting in the Philippines sank a total of over 30,000 tons of shipping in Subic Bay, according to a War Department announcement.

**March 4.** Bombers of the Royal Air Force attacked the Renault plant and other factories manufacturing war material for Germany at Billancourt and other Paris suburbs.

**March 6.** U.S. bombers left Java. Lack of escort fighters was indicated as the cause of their forced abandonment of the island.

**March 7.** Maj. Gen. Follett Bradley assumed command of the First Air Force at Mitchell Field, replacing Brig. Gen. Arnold N. Krogstad who was transferred to other duty.

**March 9.** Admiral Ernest J. King was named Chief of Naval Operations and Commander-in-Chief of the U.S. Fleet.

**March 10.** Major General J. T. McNarney, U.S. Army Air Forces, was named Deputy Chief of Staff.

*"ATTACK DIVE" by John Hammer*

***A SAFE 680 M.P.H.*** . . . It takes exceptional engineering to build an airplane that is safe in a 680 m.p.h. dive. Thrusting downward at this prodigious speed—or outclimbing, outflying, outgunning all contemporaries—the sensational Republic *P-47* THUNDERBOLT is the tangible expression of the high engineering skill which planned it to the last detail. Republic Aviation Corporation, Farmingdale, Long Island, N. Y.

REPUBLIC AVIATION

**REPUBLIC AVIATION**

# Air Transport Developments During 1941

WILLIAM LITTLEWOOD*

THE YEAR 1941 in the air transport industry, as in many other industries, has been characterized by substantially increased activity and refinement of equipment engineering and operating technique rather than extensive development of new equipment models or the application of such models to operating service. This of course has been the result of increasing concentration throughout the year on the development and manufacture of military equipment and of the airlines activities in the associated industrial effort, culminating in December, 1941, in the actual declaration of war by the United States, which automatically turned the attention of everyone to that prime problem. A great deal of the thought and effort expended by the aircraft manufacturers, by the government regulatory and technical agencies, and by the airlines in connection with the prime military project has been reflected in the plans and activities of the air transport industry and in the future will unquestionably influence to an incalculable extent the technical development, construction, and operation of aircraft for commercial use.

In the preparation of this review a conscientious effort has been made to solicit from the government regulatory and technical development agencies, from all the aircraft manufacturers, and from all the airline operators statements covering air transport projects in production or use or under development by them during the year 1941. It must of course be recognized that many of the projects under development, notably by the federal technical development agencies and by the aircraft manufacturers, are necessarily on the military restricted list at this time and could not, therefore, be disclosed or discussed. It seems proper to classify the review under four main headings according to the sources from which the information was obtained.

## CIVIL AERONAUTICS BOARD

The following is a partial list of air transport projects to which the attention of the Civil Aeronautics Board has been directed during the past year:

### *Developments Adopted or Completed*

*Altitude of Flights.* This regulation prohibits flight above 3,500 feet from the ground without a flight plan. It also contains other elements of control in the interests of safety, all being directed toward preventing collision in the air. It was adopted June 24, 1941.

*Occupancy of the Pilot's Compartment* was restricted by regulation adopted January 14, 1941.

*Oxygen Apparatus.* On February 4, 1941, the Board added regulations regarding oxygen apparatus and its use. No air carrier aircraft shall be operated in scheduled air transportation at an altitude exceeding 10,000 feet above sea level continuously for more than 30 minutes, or at an altitude exceeding 12,000 feet above sea level for any length of time, unless such aircraft is equipped with an effective oxygen apparatus, an adequate supply of oxygen is available for the convenient use of the operating crew, and proper use is made of such apparatus.

*Recording Barograph.* On February 21, 1941, the Board passed a regulation that requires an altitude recording device.

*Letters of Competency for the Airlines* were revised in March, 1941, with regard to flying under icing conditions and low ceilings. This was again revised in November.

*Off-Beam Operation.* Another regulation adopted allows scheduled air carriers to operate over routes over which there is no radio beam if the aircraft is equipped with suitable directional finding apparatus.

*Certification of Pilots.* The method of certificating pilots was changed from a gross weight to a horsepower basis on June 6, 1941.

*Flight Activities at Commercial Airports.* Students may no longer practice spirals to a spot landing around busy airports. This was done by an amendment to the regulations dated February 25, 1941. The elimination of this practice does away with a serious collision hazard.

### *Projects Under Development During 1941*

*Type Certification of Instruments.*

*Master Instrument Rating.* Instrument ratings are to be divided into two parts by the establishment of a so-called Master's grade, which would be given to pilots of the caliber of airline captains and will give them the same privileges they now have. The other—the name of which has not yet been designated but which may be referred to as instrument rating—will limit a pilot to fly on instruments subject to the permission of Airways Traffic Control who are to guide him away from busy air terminals where the inexperienced instrument pilot might be a hazard to other traffic.

*Dual Tail Lights.* The best arrangement appears to be a white and red flashing tail light. Tests are satisfactory and a regulation is under preparation. The use of supplementary lighting is also being studied.

*Further Study of Lightning.* Tests have been made on lightning effects on gas tanks and on windshields. The problem of guarding a pilot's vision from lightning is still under consideration.

*Investigation of Propeller Cavitation.* A study of this feathering propeller phenomenon occurring on sudden application of power with low airplane speed is being made.

*Take-Off and Landing Test Regulations.* Study and development of Amendment 56 covering take-off and landing requirements for transport airplanes.

*Control Towers.* The Board has under consideration, and will probably adopt, regulations that will require certain minimum equipment for control towers.

### *Other Regulations*

Other regulations under consideration by the C.A.A. and C.A.B. during 1941 include the issuance of air carrier operating certificates to air carriers engaged in nonscheduled transportation; an elaboration of the requirements for pilots to become copilots and for copilots to become captains; a subdivision of mechanic's ratings into a large number of categories; a revision of Part 60 of the Civil Air Regulations (air traffic rules, to simplify them and eliminate all unnecessary material); a proposed recommendation regarding certification of parachute riggers; and a proposed amendment to Part 04 of the Regulations governing power plant installations (as distinct from certification of engines).

## NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS

During the calendar year 1941 the N.A.C.A. has greatly extended its study of problems that directly affect airline safety and economy. A brief summary of several of these studies is given in the following paragraphs.

*Airplane De-icing.* An intensive series of airplane de-icing tests have been under way using the Committee's

* Vice-President, Engineering, American Airlines.

Lockheed 12 airplane. Several types of heated wing and tail surface arrangements have been flown in all kinds of icing conditions. Propeller de-icing and windshield de-icing have received considerable attention and much valuable experience has been obtained. Several ice-indicating instruments have been tested. The most important result of this research is that the ability of a properly heated wing to remain free from ice under the most severe icing conditions thus far encountered has been demonstrated. Studies of windshields have indicated that a double windshield with a thin interspace supplied with heated air will effectively prevent ice accumulation.

*Airplane Heaters.* A companion study to the airplane de-icing work has recently been begun on airplane heaters. The principal source of heat in the N.A.C.A. Lockheed 12 airplane is the engine exhaust. Several features of this system indicate that the installation could be simplified by the use of small heating units properly distributed throughout the airplane. The investigation of airplane heating devices will provide comparative data on the performance of combustion and other types of heaters suitable for wing and windshield de-icing as well as cabin heating.

*Carburetor and Induction System De-icing.* For several months a research program has been under way at the National Bureau of Standards on the study of induction system de-icing. Carburetor operation is simulated under carefully controlled conditions and the formation and removal of ice can be conveniently studied in the laboratory. The conditions that cause the formation of dangerous ice in the induction system have been determined and several means of eliminating such ice are now under study. Recently an ice detector has been developed which has promise of being suitable for installation in aircraft in actual service. Studies are also being made on the effects of the induction system design on icing, and improved types of carburetor scoops are being developed. This work is closely coordinated with work of carburetor manufacturers, N.A.C.A., the Canadian Research Council, and other research agencies. The engine companies and airlines are studying this problem independently and have contributed considerably to the investigation.

*Flight Loads.* Statistical information on loads encountered in flight is being obtained from aircraft in all types of service. The N.A.C.A. V.-G. recorder has proved invaluable in this work and knowledge of flight accelerations is being constantly increased. In addition to the work with the airlines, Government services, and C.A.A., the N.A.C.A. is also conducting special flight research using the Lockheed XC-35 pressure cabin airplane. This ship is being flown at high altitudes through storm conditions. The structure of storm formations and the resulting loads on the airplane are being studied in this way.

*Impact Testing of Windshields.* The effort to develop windshield materials and types of construction which will withstand the impact of birds is being continued. Studies to simulate actual impacts have been extended and it is believed that such impacts can now be closely duplicated in the laboratory. Many windshield materials have been investigated and recommendations have been made to aircraft manufacturers as a result of these tests.

*Lightning.* The mechanical and physiologic effects of lightning on the airplane and its crew have received considerable attention in the past year. Through the cooperation of the C.A.A., the Douglas Aircraft Company, and the General Electric Company a series of tests have been run at the Pittsfield High Voltage Laboratory of the General Electric Company. In these tests lightning strikes to windshields, control surfaces, fuel tanks, and portions of the aircraft structure are simulated in the laboratory. The physiologic problems involved in this work are being studied at the National Bureau of Standards and by the Committee on Aviation Medicine of the National Research Council. The Weather Bureau is also aiding materially in this work. At the present time it appears unlikely that serious mechanical failure will occur to the airplane structure as a result of a lightning strike. However, the physiologic problems involving temporary loss of vision of the pilot and acoustic shock must receive further attention.

*General Aerodynamic Research.* The entire field of aerodynamic research points toward an increase in safety and operating economy of the airlines. In particular, the studies of stability and control effectiveness are directly related to safety. Recent research on propellers have indicated methods of increasing the efficiency of the power plant unit. Improved high lift devices will reduce the necessity for longer runways by decreasing the landing and take-off speeds of airplanes and the general development of improved aerodynamic forms of airplanes will indicate types suitable for use in the near future.

*Structural Studies.* The structural research facilities of the Committee have been greatly expanded in the past year. The principal work in this field has been the development of improved methods for computing the structural loads in aircraft and the designing of more efficient structures. Flutter problems are also receiving considerable attention. Improved methods for riveting and spot welding are under development under N.A.C.A. direction and it is believed that these studies will indicate ways of producing more efficient types of construction and simplifying maintenance problems.

*Engine Research.* The Fuels and Lubricants Subcommittee of the N.A.C.A. has under its direction several important programs on the development of improved fuels and lubricants. Many of the latest findings of the group are made available immediately to the airlines. Other work on the development of improved cooling methods, heat transfer devices, superchargers, spark plugs, and many other items of engine research are now under way.

*Materials Research.* The present war effort has caused the aircraft industry to search for additional materials to supplement the conventional aluminum alloy type of construction. The N.A.C.A. Aircraft Materials Committee is aiding considerably in this work. Under the direction of this group studies are being made of magnesium alloys, plastic and wood materials, stainless steel, aircraft steel tubing of various alloys, and many other materials that will undoubtedly find ready use in aircraft.

These items constitute only a small portion of the activities of the N.A.C.A. which directly or indirectly benefit the air transport industry. Since the present international situation demands that all possible effort be directed toward solving the problems of the Army and Navy air arms, a large portion of the work of the N.A.C.A. directly involves military aircraft. However, all aircraft operate in the same medium and face similar problems in obtaining the maximum possible range and safety. For this reason the airlines are in position to use to advantage a large share of the results of present defense research in aeronautics.

## Air Transport Aircraft Manufacturers

Throughout the year a constantly increasing percentage of the rapidly expanded engineering and production capacity of the aircraft manufacturers has been devoted to military models. Production of existing air transport airplanes has continued to a limited extent and conversions of such models for improved military utilization have been engineered and produced. Similarly, other models originally intended for commercial air transport use but not ready for production during 1941 have been modified for military use, and development and production plans for such airplanes have proceeded. There have also been developed during the year a number of military types of airplanes which may eventually find commercial application, and the designers and producers of such aircraft have during this period given thought to the eventual

commercial utility of possible conversions of these models. Such airplanes are of course on the restricted list and cannot be discussed here. The following review can, therefore, concern itself only with such airplanes as were originally conceived for commercial use and have been produced and operated in that form during the year or had been originally conceived for commercial use and have been modified for military utilization and are capable of ready reconversion to their commercial counterparts.

*Beech Aircraft Corporation.* Prior to 1941 this company produced a number of Model 18 twin engine Beecherafts for use by airlines in South America and Canada. During the year adaptations of this model were produced for military use. The company states that the model will undoubtedly be modified and improved when future commercial production is resumed.

*Boeing Aircraft Company.* During the past year this company was engaged entirely in the design and development of military aircraft. However, its products should be mentioned in consideration of the fact that during 1941 Boeing Stratoliners were the only four engine transports operating on domestic airlines in America and were the only commercial transports with supercharged cabins in actual service throughout the year. During this period the company has been engaged in extensive research programs embracing high altitude and cold weather operation, the results of which will undoubtedly be applicable to future transport design. The company has stated that it will, when the national emergency permits, expend extensive efforts toward the development of air transport aircraft.

*Cessna Aircraft Company.* This company advises that the close of 1941 finds it in production on a number of Cessna T-50 twin engine aircraft for commercial use. The airplane is recommended by its manufacturer as suitable for light haul or feeder line service in addition to route check and pilot training requirements of the airlines.

*Consolidated Aircraft Corporation.* This manufacturer advises that while they have had no strictly commercial airplanes in production during the past year they have nevertheless studied modifications of their multi-engine military airplanes which would adapt them for commercial use. They feel that the extensive use of the B-24 type bomber in ferrying operations across the Atlantic has helped greatly to demonstrate the practicability of commercial landplane operation over water. Extensive development work accomplished during the year may well find later application in the company's possible future production of commercial aircraft. Consolidated feels that the application of airplane heat deicing to their PBY boat has demonstrated in service the practicability of this method of ice protection and has supplemented in a practical way the investigations of the N.A.C.A. in this field. They also state that they have worked intensively with Stewart-Warner in the development of airplane heater units of the fuel burning type, which they feel offer a definite improvement over other types of airplane heating commonly used.

In Consolidated's opinion 1941 has firmly established the tricycle landing gear as the future type for both military and commercial aircraft. They also emphasize the improvements accomplished and in process in the development of wing flaps, stating: "The tricycle landing gear and the improved wing flaps are two major factors for making the use of relatively high wing loadings entirely practical. The effective or equivalent wing loading with the flap down is the real determining factor which is frequently overlooked in discussions of this subject." For future commercial use Consolidated also emphasizes the research work accomplished during 1941 in connection with airplane noise reduction. The company emphasizes the importance of adequate propeller tip clearance to the fuselage and the value of low propeller tip speeds in achieving the desired sound level within the cabin. They also point out the intensive work accomplished during the past year in connection with high altitude operation with particular reference to the development of suitable compressor and accessory control equipment for cabin supercharging. They feel that their military models in production or under development during 1941 will be readily adaptable to commercial passenger operation to carry from 10 to as many as 75 passengers in both landplane types and flying boats.

*Curtiss-Wright Corporation.* During 1941, along with the extensive military design and production, Curtiss-Wright have continued development and production plans for the construction of a large number of the C-46 transport and cargo airplane, which is an outgrowth of the twin engine CW-20 originally conceived as a commercial passenger and cargo airplane. The Model 20E is the designation of a possible re-conversion of the military airplane for commercial use, and the details of its engineering and production are now under consideration. Technical data previously released in connection with the CW-20 should be equally applicable to the Model 20E. It is interesting to note that according to present figures available this twin engine airplane has weight and performance characteristics indicating that it is the most efficient commercial aircraft which has reached such an advanced stage of development, the first model having been flown extensively during 1941 and substantially confirming the anticipated performance characteristics.

*Douglas Aircraft Company.* Throughout the past year, amid intensive military activity, Douglas has continued production of a limited number of airline DC-3's and has had modifications of that design for more particular military utilization. They have continued the development of the four engine DC-4 with prime consideration to its use as a long range commercial and military transport and cargo airplane. The DC-3 airplane as produced during 1941 does not differ substantially from similar airplanes produced in previous years. However, it is interesting to note that during the year the airlines achieved standardization of DC-3 specifications in all essential and major elements entirely consistent with the ready conversion of such airplanes to possible military use. The DC-3 as planned during 1941 to be produced in 1942 is identical in all major elements with the C-53 military model, and it will be modified for commercial use in such a manner as to be readily converted to the standard military type airplane.

Exactly the same position has been taken with reference to the four engine DC-4 and, while it is not apparent at the present time how many such airplanes may be available for commercial use, the military requirements are given prime consideration and the corresponding conversions to and from commercial use have been planned. Other commercial models for future Douglas production have been studied during the past year. However, the first consideration of such studies has been the immediate military utility of the proposed airplanes with proper thought only as to the commercial conversion possibilities.

*Grumman Aircraft Engineering Corporation.* While this company's engineering and production throughout 1941 has been largely devoted to military types, they have had available the model G-21 and G-41 twin engine amphibians for commercial transport use. Although these airplanes were designed particularly for private owner operation, the model G-21 powered with two 400 hp. Wasp, Jr., engines has been used for certain airline operations.

*Lockheed Aircraft Corporation.* In addition to intensive military engineering and production, Lockheed has during 1941 produced a number of Model 18 Lodestars and Model 12 transport airplanes Both of these are twin engine airplanes built to specifications applying to similar types constructed during the previous year. During 1941 the airlines also achieved standardization of all major elements of the Lockheed Lodestar with prime consideration of the military utility of this type. In addition to airline application of Lodestars during the year, a number of such airplanes

were also arranged for troop transport and ambulance service in connection with military activities outside the United States. The smaller Lockheed, Model 12, while used to some extent as a private commercial airplane, is considered by Lockheed as entirely suitable for feeder line use as well as route checking and pilot training. During 1941 Lockheed continued to build a substantial number of Model 414 Hudson Reconnaissance bombers originally developed from the Lockheed 14 commercial airplane. One of the major developments cited by Lockheed during the past year was the installation of an experimental exhaust heated wing and windshield deicer system in a Lockheed Model 12 for research study by the N.A.C.A.

*The Glenn L. Martin Company.* Whereas Martin engineering and production throughout 1941 has been devoted entirely to military models, several of their projects and most particularly the large flying boat, the "Mars," have commercial applications that cannot be neglected in this review. Their expressed opinion is that flying boats of this type in this and larger tonnage classifications will prove more acceptable than landplanes for transoceanic service. They also express the opinion that wartime developments and experience will influence postwar commercial trends toward the acceptances of higher landing speeds and wing loadings, high altitude operation for long hauls through the perfection of engine and cabin supercharging equipment, lower costs for aircraft through the development of improved manufacturing methods, and the discovery that some of the "substitute" materials, such as plastics, are really superior to the hitherto conventional materials for certain applications. They also express confidence in the early perfection and widespread use of heat de-icing for aircraft.

*Bristol Aircraft Division of Universal Molded Products Corporation.* During 1941 this company has not had in production any aircraft that might properly be considered in the transport category. However, it advises that it has had under development during that period a twin engine five place passenger airplane designated Model 21-A intended for airline feeder service, pilot training, and route checking. It is also developing, starting in 1941, a proposed cargo airplane of twin engine type designated as the Model 22.

*Vought-Sikorsky Aircraft Division, United Aircraft Corporation.* In addition to this company's extensive engineering and production of military models, the year 1941 was notable for the accomplishment of the design and construction of the VS-44A flying boat. This four engine boat of 124 ft. wing span and 57,500 lbs. provisional gross weight is intended for transoceanic flying. It is reported to have a high speed of 235 m.p.h. at normal gross weight of 50,000 lbs., a fuel capacity of 3,820 gallons, and a passenger capacity of 32 day or 16 sleeper passengers with a crew of 12. Vought-Sikorsky states that studies are being undertaken toward the construction of larger flying boats for commercial use.

## Airline Operators

Airline activities during 1941 have of necessity been predicated on a minimum expansion of equipment and consequently only minor changes in routes and schedules have been made. Nevertheless, there has been a marked increase in passengers, cargo, and mail handled and a consequent increase in airline activity and personnel. The year has also been characterized by innumerable refinements of operating, maintenance, and engineering techniques. One of the inevitable results of the personnel problem has been the intensification of training school activities by all the airlines. Such school activities include: (1) pilot training, both ground and flight; (2) steward or stewardess training; (3) station, reservation, and ticket agents; (4) flight dispatchers; (5) mechanics training, both classroom and shop; and (6) apprentice engineering training.

On December 23, 1941, the air-mail pick-up service operated by All American Aviation, Inc., completed its first million miles of flying. This novel service by which mail and express are collected and delivered by airplane nonstop embraces five routes covering 112 cities and towns in the middle east and has established a noteworthy record of accomplishment. The future development of this type of transport will be studied with interest. The past year also noted the formation of Air Cargo, Inc., an organization established to investigate from all angles the problems incidental to the handling of cargo by air transport for the information and guidance of the airlines in their future activities in that tremendous field.

The airlines throughout 1941 have worked individually, collectively, and in collaboration with the regulatory and technical agencies in the investigation and development of numerous projects to improve the safety and efficiency of airline operation. Space does not permit the listing or detailed discussion of all these projects and developments but the following are typical:

*Wing and Empennage De-icing.* Several airlines have service tested 7½ per cent cord increased coverage deicer boots which have indicated some superiority over the standard 5 per cent boots. Practically all boot installations now incorporate the flap covering at the attachment strip, giving an aerodynamically smoother and more ice-free installation. One airline DC-3 installation has been completed, using exhaust heated leading edges for de-icing and the installation is reported to indicate successful operation. This practical test, in addition to service experience with certain military aircraft so equipped and supplementing the N.A.C.A. research on this method of ice protection, occasions the greatest airline interest in its future possibilities.

*Propeller Ice Protection.* Airline experience has indicated the general acceptance of alcohol for propeller ice protection instead of the alcohol-glycerine mixtures formerly used. Satisfactory use of this material permits simplification of the alcohol system, since the one material can now be used for all alcohol ice protection purposes. The principal development in propeller ice protection has, however, been the more general adoption of propeller blade leading edge shoes to improve alcohol distribution over the blades. The airlines continue to await with great interest the possible development of an electrical heat method for propeller ice protection.

*Windshield Wipers and Ice Protection.* The installation of hydraulic and electrically operated windshield wipers on airline aircraft has been widely extended and they are generally recognized as a great improvement under rain conditions. The supplementary problem of clearing ice from the windshields has been approached by the addition of alcohol sprays to the windshield exterior, hot air application to the windshield interior, and the use of double windshields with hot air or heated liquid between the glasses. Which method or combination of methods is best from the weight, vision, and ice clearing characteristics remains to be determined.

*Pitot and Radio Mast Ice Protection.* These problems are reported to be satisfactorily solved by either the use of alcohol or inflatable deicer boots.

*Airplane Icing Indicators.* Airline installations have been made of ice thickness indicators, rate of ice accretion indicators and nacelle wing lights to show ice formation at night. The light installations are intended to serve the further purposes of checking deicer boot operation and serving as additional airplane identification under conditions of poor visibility or in the vicinity of congested airports.

*Increased Strength Windshields.* In addition to the research investigation of this problem by the N.A.C.A., the airlines have accomplished the development of substantially stronger and negligibly heavier windshield glasses, a number of which have been installed.

*Ignition Harness and Spark Plugs.* Several types of improved ignition harnesses have been tested and adopted by the airlines, including features of pressurization, ventilation.

air drying, plastic sealing, and other methods of excluding moisture. Extensive spark plug service tests have been conducted using various types of mica plugs as well as ceramic spark plugs.

*Air Scoop and Heater Valve.* The greatly increased use of automatic carburetion has emphasized the necessity for improvements in air scoop design with particular reference to the effects of heater valve operation on carburetor metering characteristics. Several rationally designed and laboratory and service tested air scoop and heater valve units have been adopted by the airlines with satisfactory results.

*Induction System Ice Protection.* This project, which has constituted the subject of research study by a special Committee of the technical agencies, engine manufacturers, and airline operators, has been occasioned by recognition of the fact that all elements of the induction system, in addition to the nonicing carburetor itself, must be free or adequately protected from ice, from the carburetor air intake to the engine blower impeller. It seems reasonable to expect that the results of this Committee's work, supplemented by actual service test, will demonstrate that an induction system can be designed to be entirely ice-free or that such elements as cannot be prevented from atmospheric ice formation can be readily guarded by supplementary protection.

*Cowl Flaps.* The increased use of cowl flaps with engines of higher power to provide reasonable temperature control under the widely varying power and flight conditions has emphasized the mechanical inadequacy of existing cowl flap designs. Innumerable detail improvements have been accomplished by the airlines and several major revisions have been made.

*Vibration and Propeller Balancing.* Extensive ground and flight research has been conducted by several airlines in connection with structural, power plant, and propeller vibration conditions. Improved techniques of propeller balancing have been developed and applied, resulting not only in smoother and quieter flight operations but in substantial decreases of propeller, engine, accessory, and structural stresses.

*Oil System.* Some airline installations of the oil dilution system have been made in consideration of cold weather engine starting. Service test installations have also been made of centrifuge separators and oil filters in the interests of protecting the engines against dirt and sludge accumulations and possibly extending oil drain periods.

*Fuel System.* Several airlines have revised fuel systems substituting electric fuel pumps for starting and emergency operation in place of the hand wobble pumps formerly used. Such installation also permits elimination of the pressure cross feed line between engines. The installation of booster pumps to the tanks in some large airplanes has also been resorted to as a method of correcting vapor lock conditions.

*Torquemeters.* The use of engine torquemeters has been extensively service tested and their value as an accurate method of engine difficulty analysis and power and fuel consumption control has been indicated.

*Propellers.* The past year has noted the development and plans for the early adoption of the considerably lighter weight 33D50 hydromatic propeller for DC-3 airline airplanes.

*Heating System.* One airline has replaced its airplane steam heating system with exhaust heated hot air equipment in consideration of the weight saving and reduced maintenance involved. Other installations of Stewart-Warner fuel burning heating system have been accomplished in some airplanes. There appears to be a definite trend away from the rather complex and heavy steam heating system. Several airlines have installed automatic temperature control equipment for cabin heating regulation.

*Instruments.* Instruments undergoing development and service test by the airlines during 1941 included: (1) a cloud charge indicator used in the investigation of lightning phenomena; (2) photoelectric cell induction system ice indicators; (3) the Sperry flight ray indicator; (4) pressure transmitter units for use with fuel, oil, and other pressure gages; (5) dual indicators to conserve instrument board space; (6) wet and dry bulb aerographs for checking humidity and dew point in flight; (7) miniature autosyn instruments of various types; (8) electric primer units to generally replace hand primer pumps; and (9) fuel flow meters as a possible substitute for exhaust gas analyzers with automatic carburetion.

*Ground Air Conditioning Equipment.* Recognizing the cost and complexity of the widely used ground air conditioning units, several airlines have investigated the possibilities of simplification. Units have been built and tested, utilizing gasoline engine driven blowers and fuel burning heaters. Other units have incorporated oil burners for winter heating and ice for summer cooling. The most interesting development of 1941, however, has been the installation of at least two major airports—namely, Washington and Minneapolis—of permanent air conditioning systems with ramp outlets for the use of airline airplanes.

It is recognized that this review is incomplete in many respects. It would be impossible to cover satisfactorily the field in the limited time and space available. In closing, it is desired to acknowledge with thanks the cooperation of the many organizations and companies who have generously contributed the information on which this review is based.


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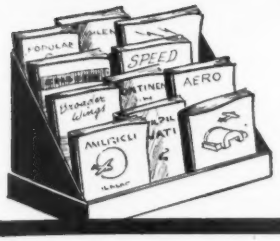


# Periodicals

*The views and opinions expressed in this section are exclusively those of the writers or publications named. They are in no case to be construed as those of the Aeronautical Engineering Review or the Institute of the Aeronautical Sciences.*

## Accessories

**Air Filters for Airplane-Engine Protection.** William K. Gregory. Discussing the application of air filters for use with aircraft engines, information is given on the selection of the proper type of filter, with a description of the oil-bath and dry-type filters, expressing the opinion that numerous advantages are to be found in the washable viscous impingement type. Considerable detail is given on the construction and performance of this type of air filter, leading to the conclusion that it deserves special consideration because of its characteristics which, in the order of their importance, are as follows: ability to maintain a high cleaning efficiency even after a large amount of dust has been accumulated, strength of construction and ability to withstand frequent and rough handling, permanency, space required for installing, weight, first cost.

Further details are given concerning the methods and materials used in testing the filters and equipment. An appendix details the apparatus and test procedure employed. *Mechanical Engineering*, March, 1942, pages 205–207, 3 illus.

**Positive Locking.** Description of the "S-L" self-locking device used for fastening retractable undercarriages, bomb-release gear, jettison hinges, gun mountings, and other parts of modern aircraft which must be readily detachable but whose locking must be positive. *Flight*, December 25, 1941, page 467, 2 illus.

**Turbo-Supercharging.** An explanation of how the exhaust-driven turbo-supercharger operates and its function in maintaining power output at high altitudes. The article outlines the object of supercharging, the principle of its operation, and its application to modern military aircraft. *Flight*, January 1, 1942, pages 10–14, 3 illus.

**By Tube All the Way.** Description of a simple flight control system that lends itself to standardization—known as the Saunders flying control. This system applies a simple tubular push-pull arrangement and permits two functions to be performed by a single member. *Flight*, January 1, 1942, pages 16, 17, 6 illus.

**Electrics versus Hydraulics.** "Indicator." The trend among many British designers, this article states, is to shy away from using electricity for accessory power except where absolutely necessary, applying hydraulic motivation wherever possible. This distrust, despite the theoretically greater reliability of electric equipment, is assumed to have grown out of the possible fire hazard present when electric auxiliary power is used. This article compares the advantages of both power sources, as well as their mixed application, as used in some American designs. *Flight*, January 8, 1942, page f.

**"Heli-Coil" Spark Plug Bushing.** Harold Caminez. A new type of spark plug bushing is described. It employs a helical coil of precision-shaped spring wire in place of the conventionally threaded solid metal bushing. The differences between the new type and older practice are shown and the advantages are indicated with reference to the use of this type of bushing in aluminum cylinder heads. Methods of overcoming the objections to conventional practices are dealt with at considerable length and the benefits offered by the new construction are shown. *Aviation*, March, 1942, pages 80, 81, 192, 195, 5 illus.

**$CO_2$ Fire Extinguishing Systems.** J. M. Noble. Advice is given on the prevention of engine fires in aircraft by means of carbon-dioxide gas. This discussion of extinguishing systems covers: safety valves, general installation, types of cylinders, checking the system, cylinder inspection, points on cable installation, and maintenance. *Aviation*, March, 1942, pages 148, 149, 3 illus.

## Aerodynamics

**The Effect of the Ground on Aeroplanes.** R. H. Warring. This article attempts to explain the "ground effect" or "cushioning" that is experi-

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*British Press Service*

One of the latest additions to the Royal Air Force's fighting line, the Westland *Whirlwind*, a single-seater fighter, powered by two Rolls-Royce *Peregrine* 850 hp. engines. The craft is armed with four 20 mm. Hispano type shell-firing cannon. The range of this craft is indicated by the fact that it has been used in operations against Antwerp, Cologne and points even further in enemy territory.

enced while landing or during short hops close to the landing field. The foundation for the theory advanced in this article is the existence of a mirror image of the existent wings when the airplane is close to the ground which makes a monoplane act like a biplane and a biplane act like a multiplane. Thus, the induced drag is proportionately increased, and the flying characteristics are similarly altered. *Aeronautics*, February, 1942, pages 55–57, 6 illus.

**Effect of Variable Viscosity on Boundary Layers, with a Discussion of Drag Measurements.** J. G. Brainerd and H. W. Emmons. This paper extends a previously reported investigation of the boundary-layer problem associated with the steady laminar flow of a perfect gas along a thin flat insulated plate. In the earlier study the viscosity was assumed constant and the distributions of velocity and temperature were obtained for a wide range of conditions. Part I of the present paper shows, for Prandtl number 0.733 (air) and Mach number of the undisturbed stream 2, the velocity and temperature distributions in the boundary layer under various assumed viscosity variations. Part II gives the distributions for various Prandtl numbers and Mach numbers, assuming the same viscosity functions as used by von Kármán and Tsien. Part III is devoted to a discussion of the method of interpretation of traverse tests of the efficiency and flow coefficients of nozzles or other passages.

The results of Part I show that the variation of viscosity with temperature does not alter the equilibrium temperature of the plate and, hence, the reading of a plate thermometer. This result is extended in Part II, where it is shown that $\theta$ at the plate wall is equal to the same quantity when $\mu$ is taken constant to within 1 per cent in all cases studied. Furthermore, $\varphi$ U′ at the plate wall does not vary greatly, so that the drag coefficient $C_D$ is equal to $1.28/(\mathrm{Re})^{1/2}$ to within 5 per cent for most of the cases investigated. In Part III a passage efficiency as usually calculated is found to be subject to two errors, one of which reduces, and the other of which increases, the test result. The net effect is to cause the standard traverse test to give a conservative estimate of the efficiency. The flow coefficient as determined by traverse tests is somewhat higher than the correct one. *Journal of Applied Mechanics*, March, 1942, pages A-1–A-6, 12 illus.

**Geometric Airfoil Characteristics.** Charles F. Marshner. Preliminary design information is presented, calculated from certain N.A.C.A. airfoil sections. Such information is always helpful for designing engineers to save calculations. Charts and equations are included from which airfoil ordinates, depths, perimeters, section areas, and section moments of inertia can be calculated. Reference data are also given. Limitations on the recommendations for the use of the charts are set forth. *Aviation*, March, 1942, pages 73, 74, 5 illus.

**Charting Stability in Aircraft.** Part I. Cortland D. Perkins. In this first part of an article on dynamic stability are presented charts and equations concerning lateral motions of an airplane. This development is an extension of the reports on dynamic stability written by C. H. Zimmerman several years ago. It is intended to give a picture of the divergent, convergent, or oscillatory tendencies which should be useful to the designer. The graphic method of solving a quartic is explained. The application of dynamic stability charts to longitudinal motion will be taken up in a future issue of the magazine. *Aviation*, March, 1942, pages 75, 78, 79, 3 illus.

**Some Simplified Methods in Airfoil Theory.** M. A. Biot. Recalling that the use of the acceleration potential in thin airfoil theory was introduced by L. Prandtl, the writer states that the method has since been applied by several authors to problems of stationary and nonstationary flow in both compressible and incompressible fluids. A striking feature of this method is that no use has to be made of vortex wakes because the acceleration potential is everywhere continuous in the fluid. Such concepts as the trailing vortices and the induced downwash play no direct part in this theory.

The purpose of the present article is the treatment of two-dimensional airfoil theory in an incompressible fluid by the combined use of conformal transformation and the acceleration potential. This method of approach greatly simplifies the solution of certain airfoil problems.

First the reader is introduced to the fundamental properties of the acceleration potential in an incompressible fluid. Then it is shown how the problem of finding the acceleration potential can be solved by conformal representation of the airfoil on a circle and a simple relation is derived between the velocity and the "stream function" corresponding to this potential. The method is next applied to the stationary airfoil, with and without flap, and to the determination of the airfoil camber line and thickness function for a given pressure distribution along the chord. The simplicity of the method is especially apparent for the case of the oscillating airfoil, which is the subject of the last treatment. For the sake of brevity only translatory oscillations are considered. *Journal of the Aeronautical Sciences*, March, 1942, pages 185–190, 7 illus.

**Lofting Problems of Streamline Bodies.** Part 4. Carter M. Hartley and Roy A. Liming. The writers stress the urgent need for adapting practical lofting techniques to meet the increasingly exacting demands of high-speed airflow. The problem is defined and solutions are presented with information on methods of approach and the results achieved. This installment takes up a method for "matching" curves which is described in considerable detail. *Aero Digest*, March, 1942, pages 210, 213, 311, 312, 4 illus.

**An Improved Longitudinal Stability Calculation.** H. P. Liepmann. The conventional method of calculating static longitudinal stability is improved by taking into account the moment of the fuselage in addition to the wing and tail moments about the center of gravity of an airplane. The general equation for the fuselage moment, which is always unstable or stalling, is derived and presented in terms of the dynamic pressure, the angle of attack, and two constants that depend on the shape of the fuselage only. These constants are explained theoretically and approximate values for them are given. These approximations lead to a simplified equation for the fuselage moment which is correct up to an angle of attack of about 12 deg., as shown by comparison with existing experimental results. It is also pointed out that in calculating the fuselage moment for a stability investigation of an airplane the downwash induced by the wing should be taken into consideration. A static stability calculation is carried through for an airplane for which the total moment about its center of gravity is known from test results. A comparison of theoretic and experimental

values shows that the improved method is in much better agreement with tests than the conventional method of stability calculation. *Journal of the Aeronautical Sciences*, March, 1942, pages 181–184, 3 illus.

**Notable Invento Argentino (A Notable Argentine Invention.)** Angel Dusso, an Argentine inventor, is credited with the invention of a power generator that is said to work on the principle of aerodynamic forces, thereby eliminating the need for fuel. *Aeronautica Argentina*, January, 1942, page 2104.

## Air Cargo

**The Burnelli All-Wing.** The development of the use of the space inside the wing of an airplane for cargo and passengers is traced, giving information on early attempts along this line and following through to the present Burnelli container-type cargo airplane. *Air News*, March, 1942, pages 223–227, 17 illus.

**Italian Service Carries Strange Cargo.** The Italian air service, Servizi Aerei Speciali, brought into service by the war in the Mediterranean, during the first 100 days of its existence carried 635,000 lbs. of material, 19,185 persons, and covered 1,500,000 aircraft miles. On one of the service trips a Fiat C.R.42 single-seater fighter was transported inside a Savoia-Marchetti S.M.82. Photos show stowage of smaller craft in the S.M.82. *Flight*, January 8, 1942, page 28d, 2 illus.

**Air Freight for Defense.** William M. Sheehan. Stressing the vital necessity for this country to develop a large and efficient system of transportation of military supplies by air, a parallel is drawn with the helplessness of an army without supply trucks or a navy without supply ships. The writer proceeds to show that increased emphasis on the production and use of what he calls "sky trucks" will contribute to the national defense. Plans are laid out for the development of fleets of freight-carrying airplanes comparable with the merchant ships that support the operations of the Army and Navy and for air transports to carry troops as they are now carried by land and water transportation facilities. The types of aircraft to be used are discussed and considerable detail is given for the operations visualized.

Another important use of a "sky truck" auxiliary would be in speeding armament production. It is contended that such a cargo service would connect practically all industrial centers by air, bringing either coast within a single day's flight of the other and speeding rearmament transportation by six to ten times. This would also facilitate decentralization of industry. Production of 16,000 "sky trucks" per year is asked for until a total of 60,000 to 70,000 has been secured, after which an annual replacement rate of 16,000 would serve to maintain the fleet in proper, modern condition. The article concludes with the statement that such a fleet would be of substantial value after the war. *The Journal of Air Law and Commerce*, January, 1942, pages 1–19.

The Brewster *Bermuda* dive bomber.

## Air Law

**Civil Liability of Aircraft Carriers Under the Canadian Law.** B. V. Richardson. A recent case in Canada is reviewed at some length. It is expected to change existing ideas of what an airline carrier can do in the way of limiting his liability for accidents to passengers or damage to goods carried. In the past the English view, which has been followed in Canada, has been that when special conditions exempting the carrier from liability for the negligence of its servants are endorsed upon a ticket issued to, and accepted by, the passenger, and provided the passenger's attention is called to the conditions, he is bound by them. In this case, however, it has been decided that by virtue of the Transport Act, 1938, S.C., Chapter 53, and in view of the principle laid down in a 1909 case such attempts to limit or relieve from liability, at least in the case of passengers carried by air on scheduled routes and at scheduled rates or tolls, are invalid.

Apart from the main issue, there are other points of interest in the case, such as the limitation of liability on a ticket issued at a reduced rate and whether an air transport company can issue a ticket containing conditions that limit the liability of the company when a trip is taken on a special contract where there is no regular schedule in operation or where an airplane is chartered. *Air Law Review*, October, 1942, pages 345–355.

**Exclusion Clauses in Insurance Policies Relative to Aeronautics.** Grant Meade. Extracts are compiled from legal decisions bearing upon the judicial construction of words and clauses in life insurance policies intended to limit the liability of the companies in cases where death or injury are claimed to have been the result of accidents to aircraft. Changes in the judicial interpretation of the words and clauses used are traced as they were developed in step with the progress of the industry and the extension of public participation in flying. The writer concludes that it would be advisable for the courts to examine the circumstances attending the drawing up of a policy and to make their decisions on the basis of the intent of the parties as influenced by the circumstances prevailing at the date of issuance. *Air Law Review*, October, 1941, pages 356–370.

**1941 Annual Aeronautical Law Report.** George B. Logan. In his annual report to the National Association of State Aviation Officials the writer, who is counsel to the association, calls attention to two proposals that he regards as of the utmost importance. The first is the proposed Federal Aviation Liability Act and the second is the proposal that the American Bar Association withdraw its support of the Uniform Regulatory Act. Compulsory liability laws under federal jurisdiction are opposed on the ground that there is no need for such federal legislation, the record over a period of six years having shown that the accident ratio is extremely small and that such laws would tend to hamper the progress of private and commercial aviation. In supporting the Uniform Regulatory Act, the report stresses that state regulation has proved entirely adequate and satisfactory and that continuation of state regulation will best serve the interests of the country through the encouragement of civilian flying, which is regarded as of the greatest importance

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in the long run. The report concludes with a digest of some outstanding cases involving the operation of aircraft. *Journal of Air Law and Commerce*, January, 1942, pages 20–38.

**Aviation ABC's of the Railway Labor Act.** C. Allen Elggren and Robert M. McCraith. A simple and brief explanation is attempted of the major features of the Railway Labor Act in relation to common carriers by air and their employees. The law is examined in the light of its purposes, which are primarily for the settlement of disputes by the interested parties. Discussion is divided into sections covering duties in collective bargaining, adjustment boards, the National Mediation Board, arbitration, emergency boards, and the penalty provisions of the Act. *Journal of Air Law and Commerce*, January, 1942, pages 39–53.

**What Is a Feeder Air Line?** John H. Frederick and William J. Hudson. Definitions are attempted of feeder airlines and trunk lines, with an explanation of the differences between the two classes of service. Functions of the lines are discussed from the standpoint of territory covered, equipment and operating organization. *Journal of Air Law and Commerce*, January, 1942, pp. 54–60.

# Air Power

**Japan in the Air.** A survey taken chiefly from previous published material on Japanese air power describing her aircraft industry, her 15 aircraft plants and nine engine factories, and some of the new types of fighters being developed in the Far East. *Flight*, December 25, 1941, pages 469, 470, 3 illus.

**Australia's Air Effort.** Norman J. Tracy. A survey of the types of aircraft and their components which comprise Australia's air force. *Canadian Aviation*, February, 1942, pages 21–23, 76, 7 illus.

**Britain Builds Striking Power.** Floyd S. Chalmers. Observations on the British aircraft industry and its collaboration with the Royal Air Force by a visitor from Canada. The conclusions he draws are optimistic. *Canadian Aviation*, January, 1942, pages 29–31, 82, 3 illus.

**Imitation Air Fleet.** Steven Hnyda. Some of the present types of Japanese military and naval aircraft are described, tracing their resemblances to United States, British, Dutch, and German units. Comments are added on the performance of various Japanese airplanes, their number is estimated, and several silhouettes are reproduced. *Canadian Air Cadet*, February, 1942, pages 4, 5, 30, 3 illus.

**La Defensa Antiaerea (Anti-Aircraft Defense).** Oscar Herreros. The lessons taught by the present war are applied in this article to the organization of an efficient anti-aircraft defense. For active defense a distinction is made between defense mediums in the air and on the ground. In the first category are placed alarm and interception, while the latter includes anti-aircraft artillery (cannons and machine guns), barrage balloons, listening devices, and searchlights.

Passive anti-aircraft defense is divided into classes including: vigilance and alarm, trench and shelter, evacuation, fire, police, sanitary, recruiting and auxiliary manual work, and transportation services. *Revista de la Fuerza Aerea*, October-November-December, 1941, pages 29–37.

**Las Barreras de Globos, como Integrantes de la Defensa Pasiva de las Ciudades (Balloon Barrages, An Essential Part of the Passive Air Defense of Cities).** Descriptions are given of barrage balloons and their application to the anti-aircraft defense of cities. *Revista de la Fueraz Aerea*, October-November-December, 1941, pages 83–85.

**Japanese Strength.** Although no authoritative information is available about the Japanese military and naval air strength, this review attempts to assess it from the data at hand, comparing it with that of the British and United States forces. Japan's fundamental weaknesses are delineated as lack of design skill and of industrial capacity. A tabulation, reproduced from *The Aeroplane*, gives the number, make, and major specifications of the airplanes believed to be possessed by the Japanese army and navy. *Aircraft*, January, 1942, pages 11, 12, 36, 1 illus.

**Russia's Air Power.** This synopsis of observations on Russia's air might treats separately of the strategic resources of raw materials, organization and development of the aircraft industry, and the staying power of the Red air arm. Without probing into statistics of current production, its opinions are derived from certain facts that form a basis for casting a light on the human and material sources of Soviet air power.

Although indicating several obvious bottlenecks from a summary of the organization, personnel, and technical efficiency, the writer's conclusion is that the Russians are not being left behind by any one of the major powers. He also lists brief descriptions of each of the Russian airplanes. *Flight*, January 29, 1942, pages 92e–92h, 93, 8 illus.

**The Economy of Air Power.** Reprints of a letter to the *London Times* and two articles in the *London Daily Telegraph* written by Marshall of the Royal Air Force, Lord Trenchard, in defense of an autonomous Air Force. In interpreting the relationship between the Royal Air Force and the other services, the claim is offered that the air arm gains in flexibility and power of concentration for particular purposes by being a separate service. It is pointed out wherein all strategy is interdependent and interlocked but that air warfare has its own technique and its own tactics and must have its special administrative foundations.

Lord Trenchard's comparison of the Royal Air Force with the German Air Force, also an autonomous service, concedes the superiority to the Germans in the following: first, in their centralized high direction which controls and coordinates the effort of all three services; second, in the fact that they have remolded naval and military technique to allot air power its proper share in their plans. *The Aeroplane*, February 13, 1942, pages 178–180, 4 illus.

**Growth of Fire Power in Navy Planes.** The progress and development of bombs and their use are detailed in this second installment, which shows some of the crude early attempts at devices for bomb launching. It traces the history of bombing operations in the Navy. The development of certain types of bombing airplanes is also outlined chronologically, with brief comments on their performance. *Aero Digest*, March, 1942, pages 64, 65, 312, 7 illus.

## Air Transport

**Air Mail and the War, XIX.** Dr. Max Kronstein. The nineteenth installment of a report on air-mail activities gives data on operations in Britain and in North America and South America. It gives figures on the mail carried and tells of the discontinuation of certain lines and the establishment of others. *Airpost Journal*, February, 1942, pages 156, 160.

**The 250th Flight of the K.N.I.L.M. to Sydney.** On December 19, 1941, the two hundred and fiftieth flight from the Dutch East Indies to Australia took place. Details are given of these flights which have been maintained on a twice-weekly schedule with all accommodations fully taken. The history of the line is traced from July 3, 1938, when the Batavia to Sydney route was opened, marking the establishment of the connecting link in the line from Amsterdam and London to Sydney, a trip made in eight days by

Lockheed Super Electra-14's, selected for their long cruising radius and high speed. Later, when traffic expanded, roomier Douglas DC-3's were put in service. Expansion of the operation is indicated from 1,700,000 passenger-km. in the first six months of 1938 to approximately 9,000,000 in 1941. *Vliegwereld*, December 18, 1941, pages 728, 729, 3 illus.

**Airlines at an "Alert" Peak of Efficiency.** Edgar S. Gorrell. The president of the Air Transport Association of America reviews the vital services performed by the airlines of the nation in speeding the war program. In the construction and operation of armament plants, the airlines are transporting personnel, drawings, and materials in hours or minutes instead of days, annihilating distance. He explains the necessity for maintaining the civil airlines at the peak of efficiency and points out especially the importance of the overseas operations of Pan American Airways. *National Aeronautics*, February, 1942, pages 12, 24, 2 illus.

**"Pacific Clipper" Circles Globe While Racing War.** Overtaken by the events of December 7 while on a scheduled flight across the South Pacific to Australasia, Capt. Robert Ford in command of the Pacific Clipper successfully carried out plans previously made to meet just such an emergency. This account reveals as many of the details as may now be published of the way the Clipper crew of specialists landed passengers, mail, and air express in New Zealand; picked up personnel and supplies from Australian bases of Pan American Airways; and proceeded to make a flight westward to its Atlantic base in New York, involving what was said to be the first circumnavigation of the globe by a transport airplane. Arrangements made by the company's management, with the cooperation of government departments and British and Dutch airlines, and the smooth functioning of the crew are credited for the successful completion of a flight that the commander regarded as "a purely routine operation," covering 22,000 miles and passing over or through 12 countries with only such fragmentary contact with the ground and the usual sources of information and directions as could be used under war conditions. *U.S. Air Services*, February, 1942, pages 12–14, 1 illus.

*The irregularity of receipt of publications from abroad necessitates the review of articles in issues several months late. This is done to provide readers with information regarding foreign technical progress as soon as the issues are available in the United States.*

**The Cruise of the Berwick.** The report of the commander of the British Overseas Airways flying boat Berwick is reviewed, covering the flight from the United States to England carrying Prime Minister Churchill home from his visit to this country and Canada. Weather conditions and the operating problems encountered are related, and it is revealed that the Prime Minister piloted the aircraft for some 20 minutes with his own hands. The accuracy of the navigation is attested by the fact that the landing at Plymouth took place within one minute of the scheduled time. A brief description and some photographs of the airplane, a Boeing 314A, are included. *Flight*, February 5, 1942, pages 111, 112, 6 illus.

**"Excalibur" Joins New Transoceanic Air Fleet.** Pictures and brief


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specifications are given of the Vought-Sikorsky flying boat Excalibur, the first of three new aircraft built for the transatlantic service of the American Export lines. *Air News*, March, 1942, page 22, 3 illus.

**New C.A.B. Chairman Promises "Aggressive" Policy, Explains Attitude on War Aid for Airlines.** L. Welch Pogue, Chairman of the Civil Aeronautics Board, answers as an individual a set of a dozen questions concerning the powers, duties, problems, responsibilities, and policies of the Board. The questions and answers deal with civil aeronautics, mail lines, research, expansion, air freight, and other transport matters. *American Aviation*, March 1, 1942, pages 3, 4, 39, 2 illus.

**Aviation—After the Peace.** David Lee. Quoting C. R. Smity, president of American Airlines, Inc., the writer discusses the future of commercial air transportation and the probable centers in the United States for international airline operations. *Airlanes*, March, 1942, pages 4, 22–24, 1 illus.

**International Air Travel Simplified.** Anthony Morgan. The ease of traveling by air from New York or Chicago to Mexico is emphasized in this portrayal of a typical passenger flight via Eastern Airlines and Pan American Airways. *Airlanes*, March, 1942, pages 6, 7, 7 illus.

**Annual Civil Aviation Report.** The annual report of the Director General of the Australian Civil Aviation Department is reviewed. Figures are presented in graphic form on the passenger and freight traffic carried on regular Australian air services for the years 1932–1941. The section on the radio range system is said to be of great importance for the future. *Aircraft*, January, 1942, pages 8–10, 37, 3 illus.

**Twenty-Four Hours to Asia.** Mark and Maxine Finley. The story of Yukon Southern Air Transport, which operates over northwestern Canada and Alaska via the northern inland route, and of Grand McConachie, its president. The article covers the history of Yukon Southern from its inception in 1932 with one Fokker to its present-day place as a Canadian Pacific property and points out its significance as an air route to Bering Strait. Its methods of operation, as well as the three men who, in addition to McConachie, are responsible for them are described. *Saturday Evening Post*, March 14, 1942, pages 16, 46, 49, 53, 3 illus.

**Commercial Flying in Alaska.** Richard A. Ramme. Giving much credit to the airplane for the development of the great natural resources of Alaska, the activities of the 40 airplane companies operating there are discussed. Some of the difficulties encountered in operating under Alaskan weather conditions are indicated. *Aviation*, March, 1942, pages 58, 59, 6 illus.

# Airplane Descriptions

**Dornier Do. 217E.** Description of the improved Dornier medium bomber series 217E2 for both horizontal and dive bombing. The new type differs from previous models chiefly in its enlarged power plant consisting of two 1,600 hp. 14-cylinder B.M.W. radial engines and its increased armor and armament. *Flight*, February 12, 1942, page f.

**Through British Eyes.** A critical examination of the original Messerschmitt Me.109E points out the changes incorporated in the 109F and tells about some performance and handling tests. Its handling characteristics, cockpit control arrangements, and maintenance provisions are covered, together with a discussion of its aerodynamic features and other data. *Flight*, February 5, 1942, pages 115–120, 10 illus.

**Torpedoflugzeug He.111 (The German Torpedoplane He.111).** Pictures published in German papers show that the bomber He.111 is also being used as a torpedo plane. Two torpedo racks are substituted for the bomb racks. Thus for the first time the Luftwaffe has an airplane that can carry two torpedoes and has a cruising range exceeding that of the single-engined torpedo plane used until now. The latter characteristic may be the reason why the He.111 has been selected. It seems that this may be the beginning of a more intensified use of the air force in the battle of the Atlantic. *Schweizer Aero-Revue*, November, 1941, page 25.

**El Avion Focke-Wulf 44-J (The Focke-Wulf 44-J).** A detailed description and specifications are published on this German biplane that is used extensively for training purposes in Argentina. Drawing showing three views with overall dimensions and photographs giving details of landing gear and wing structure are included. *Aeronautica*, November, 1941, pages 8, 9, 32, 3 illus.

**Beaufighter.** The equipment, armament, and specifications of this powerful British fighter airplane are set forth, with an account of some of its achievements. *Canadian Air Cadet*, February, 1942, page 10, 1 illus.

**4-Engined Bombers.** G. H. Descriptions of the two four-engined landplane bombers developed by the British, the Handley-Page Halifax, and the Short Stirling. The article offers a comparison between the two types as to structure, power, equipment, and armament. *Aeronautics*, February, 1942, pages 64–69, 8 illus.

**The Short Stirling.** Description of Britain's largest four-engined landplane bomber, the Short Stirling, giving details on its engineering, construction, power, and armament. *The Aeroplane*, January 30, 1942, pages 133–135, 7 illus.; also *Flight*, January 29, 1942, pages 94–101, 13 illus.

**A Novel Fighter Design.** A brief description of the mock-up of the Manta airplane incorporating the Davis wing. Of great thickness and low aspect ration, the wing is said to avoid tip stalling. *Flight*, January 29, 1942, page 92d, 3 illus.

**The Guardian.** Description of a British light trainer built chiefly for Civil Air Guard instruction. This airplane features side-by-side seating, tricycle landing gear, and arrangements for high visibility. It is a high wing monoplane, powered by a 90 hp. Cirrus "minor" engine. *Flight*, December 25, 1941, pages 462e, 462f, 6 illus.

**Boulton Paul Defiant.** A history and description of the Boulton Paul Defiant two-place fighter. The article points out the tactical advantages of the airplane and explains the simplified "split" construction methods applied for the more rapid production of this type. *Flight*, February 12, 1942, pages 132–135, 6 illus.

**The Junkers Ju.88 A-6.** Description of the Junkers Ju.88 A-6 twin-engined low-wing combination horizontal and dive bomber and an account of its performance. These figures were secured by the Ministry of Aircraft Production from a series of trials run in England on a reconditioned captured airplane. *Flight*, February 12, 1942, pages 138–141, 9 illus.

**New R.A.F. Types. XVII. The Boeing 17 Fortress 1 Bomber with Exhaust-Driven Turbo-Superchargers.** Photographs, a three-view sketch, and brief specifications are reproduced. *Aircraft Engineering*, February, 1942, pages 40, 41, 48, 5 illus.

**Manta Long-Range Fighter.** New ideas on airfoil design for fast, long-range fighters capable of convoying bombers 2,500 miles or more are discussed. The characteristics of aircraft thus equipped are set forth. Information is included on the adoption of the Davis wing by Consolidated Aircraft after a series of wind-tunnel tests.

The armament of an airplane built to these specifications is also outlined. *Aero Digest*, March, 1942, pages 248, 312, 4 illus.

**Handley-Page "Halifax" Heavy Bomber.** The design and construction of the Handley-Page "Halifax"

are described briefly, comparing it with the Avro Manchester and other heavy bombing airplanes. No important technical details can be published about this recent airplane other than figures indicating its size and general construction features. *Aero Digest*, March, 1942, page 247, 1 illus.

**Japanese Aircraft.** Photographs and silhouettes with overall dimensions of several types of Japanese aircraft are reproduced. Indications are given of the American, German, French, or Italian designs from which these are believed to have been copied, with estimates of their speed and range. *Aviation*, March, 1942, pages 60, 61, 20 illus.

## Airports

**Grass for Your Landings.** Jennings Randolph. The representative from West Virginia calls attention to the importance of sodding airports with the proper kinds of grass to prevent damage by dust to aircraft engines, citing the case of one field where it was found that excess dust in 500 hours of flying had caused as much cylinder wear as would normally occur in 5,000 hours. He gives credit to the research work of Dr. John Monteith, Jr., Director of the Greens Section of the U.S. Golf Association. *National Aeronautics*, March, 1942, page 11, 1 illus.

**Defense Grant Aids Small-Town Airport.** Donald R. Warren. A concise description of the design and construction of the Ontario, California, municipal airport. *Aviation*, March, 1942, page 153, 1 illus.

## Armament

**What's New in Guns.** James L. H. Peck. A simplified explanation of the function and advantages of various types of machine guns and light ordnance used as aircraft armament, indicating the manner in which they are selected and the influence of increased fire power on the design of fighter aircraft. *Air Trails*. April, 1942, pages 10, 11, 52–54, 6 illus.

**Casting the Eggs of War.** Illustrations and brief descriptive notes cover the processes of casting the casings for aerial bombs. *Popular Science*, April, 1942, pages 102, 103, 7 illus.

**Winged Projectiles.** R. Borlase Matthews. This article presents the principle and application of a system of self-propelled automatic aerial torpedoes which differ considerably from both target aircraft and automatic robot piloting devices applied to other designs of auxiliaries for ordinary aircraft. This device is designed to convey projectiles, shells and torpedoes, or propaganda leaflets to a predetermined spot at distances that could not be reached by ordinary aircraft. The pilotless aircraft flown by giro-actuated controls is catapult launched and automatically directed on a horizontal path to a predetermined spot where the wings are released and the projectile plummets to its target. The theory, design, launching, and control of this type of projectile are discussed and the previous work done on the scheme is presented. *Flight*, December 25, 1941, pages 460–462, 2 illus.

**Aircraft and Torpedo.** The history of torpedo-carrying aircraft is traced, crediting Rear Admiral Sir Murray Fraser Sueter of the British Navy for the development of the idea and the Sopwith Company for the first production of a single-seater airplane capable of carrying a torpedo. The writer states that a few weeks prior to the outbreak of the first World War a torpedo was launched from the air for the first time in the history of aeronautics. Further attempts were made during that conflict to design airplanes capable of carrying torpedoes up to 1,000 lbs. in weight, but production was undertaken only toward the close of the war, and little additional progress was made until recently when means have been found to carry more

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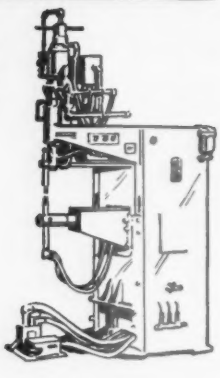

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than one torpedo. The need for further development of methods for launching and controlling the torpedo is stressed. *Inter Avia*, December 5, 1942, pages 1–3.

**Cable Cutters.** A pictorial comparison between the German and British methods of protecting bombers against barrage balloon cables. The German method is to place a V-shaped fending-off bar in front of the leading edge of the wing, while the British employ small wire cutters incorporated directly into the entering edge. *Flight*, January 8, 1942, page 27, 4 illus.

## Avigation

**The Cartographic Solution of Great Circle Problems.** A. J. Dilloway. This paper deals with two of the four possible methods of attacking spherical problems—(1) the solution by measurement between plotted positions on normal projections and (2) graphic and mechanical adaptations of certain map projections.

These two solutions correspond, respectively, to what might be called a "pure" and "applied" use of projections in measuring spherical relations. A good deal of work has been done on the various aspects of such problems but the subject as a whole has received no systematic treatment. The paper therefore attempts a comprehensive survey of various methods at present available, considerations in relation to them, and certain new lines of approach which further study has suggested. The discussion is essentially a graphic one because the search was largely for simplicity and convenience of measurement. As the most typical examples of every kind of practical problem are to be found in the work of the long distance air navigator, the subject as a whole is treated from the navigational point of view. *The Journal of the Royal Aeronautical Society*, January, 1942, pages 4–31, 11 illus.

**Eenvoudige Navigatie ten dienste van de Sportvliegers (Simple Navigation for Sports Flyers).** The fifteenth of a series of articles on air navigation, this one has as its subject the Range and Bearing Method and the Quick Turn Method. *Luchtvaart*, November, 1941, pages 445–447.

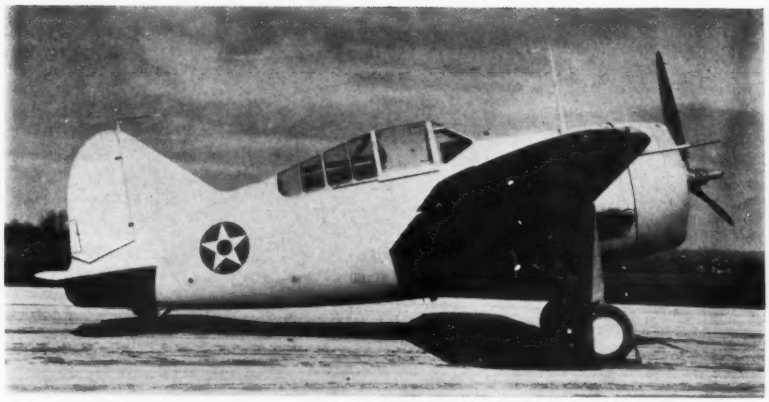
**The Stars This March.** Warren C. Youngclaus. Astronomic data on the heavens during the month of March are presented for the student of celestial navigation. *Aero Digest*, March, 1942, pages 68, 304, 305, 1 illus.

## Business and Finance

**Private Flying's Future Through Financial Eyes.** Gene Royer. Important revisions of finance plans and policies on private flying. In anticipation of the continuation of private flying, one finance company is taking direct action through the extension of new airplane terms for used equipment and a more liberal program for C.P.T. contractors. They are also extending a lenient floor plan for marketable used airplanes and lower costs in financing repairs and overhauls. *Southern Flight*, February, 1942, page 37, 1 illus.

**Aviation Insurance.** E. M. Compton. An explanation of how insurance applies to aircraft and to those who operate, fly, or ride in them. The question is divided into five topical considerations: hull insurance, liability or third part insurance, accident insurance, employer's liability and voluntary compensation insurance, and airport liability insurance. *Canadian Aviation*, February, 1942, pages 32, 33, 82, 6 illus.

**Buying Protection with Insurance.** Don H. Wimmer. Based on the estimate of a volume of $600,000,000 in aircraft business in the fifth year after the war, the writer explores the field for aviation insurance and explains the requirements that the insurance companies are preparing to meet. *Aero Digest*, March, 1942, pages 72, 308.



The Brewster *Buffalo*, a U.S. Navy single-seater shipboard fighter.

## Civil Air Defense

**The Private Pilot and the War.** Charles I. Stanton. The acting administrator of the C.A.A. herein outlines the requirements necessary for civil flying. Restricted control must be exercised, he points out, for the proper precautions against improper use of private planes and pilot's certificates to the enemy's advantage. *Flying and Popular Aviation*, April, 1942, pages 23, 24, 88, 89, 3 illus.

**Why Not a Real Civil Air Patrol?** Guy Miller. A proposed plan to furnish a civilian aerial convoy for every tanker and freighter in the coastwise trade. The argument is advanced that using the Civil Air Patrol for this purpose would work out beneficially for merchant vessel crews, the Army and Navy, civilian pilots, and the public in general. *Air Facts*, March, 1942, pages 20, 21.

**The Auxiliary Air Arm.** C. B. F. Macauley. Civil Air Patrol is organizing on a national basis to utilize the vast reservoirs of man power, planes, and ground equipment represented by civilian pilots. Specific duties typical of services the C.A.P. might be called upon to render are listed, including guard duty at airports, courier service, observation patrol of back country areas, towing of aerial gunnery targets, ferry service, and mechanic personnel at civil airports. Other subjects covered are aircraft identification, patrolling highway traffic under possible evacuation conditions, and searching for military aircraft forced down or crashed in out-of-the-way areas. Present status of civil flying is outlined. *Flying and Popular Aviation*, March, 1942, pages 50–52, 73, 4 illus.

**A Private Flier Looks at the C.A.P.** George R. Clay. A proposal to utilize light planes as scouts for railroads, guardians for pipelines and high-powered transmission lines, aids to the coast guard in patrolling the coast line, and auxiliaries for air transportation. The article also advocates the training of able men over military age for the piloting of these planes. *Southern Flight*, February, 1942, pages 39, 44, 1 illus.

**C.A.A. Training Program Aiding Our War Efforts.** Karl Stefan. The Representative from Nebraska, a member of the House Committee on Appropriations, discusses the four types of C.A.A. activity, emphasizing the achievements of the program and its remarkable safety record. *Aero Digest*, March 1942, pages 63, 315, 316, 2 illus.

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## Civil Aviation

**Watch that Landing!** Stating that more accidents occur in civil nonair-carrier flying while aircraft is being landed than in any other flight operation, this is a report on what causes these accidents and some pertinent hints on how to prevent them. Findings are based on C.A.B. Safety Bureau statistics. *Yankee Pilot*, March, 1942, pages 9, 10, 17, 18.

**Private Flying and the War.** A brief summary of the restrictions placed upon private flying which contends that now that a calmer view can be taken they aren't so repressive after all. Elimination of private flying along the coastal lines, limitation of operations to established landing fields, and prohibition of flying over restricted areas are acknowledged as the greatest restrictions. The article also includes reference to the definite military contributions that can be made by light planes in offensive and convoy work in addition to behind-the-lines operations. *Aviation*, March, 1942, pages 150, 201.

# Design

**Airplanes of the Future.** A report on the activities of the Design Development Unit of the U.S. Army Air Forces, whose job is to conceive and create from the apex of present design achievement improved aircraft for the future. Traced briefly is the development of a design from its inception until it is ready to be presented to the public. *U.S. Air Services*, March, 1942, pages 10, 11, 40, 1 illus.

**Offices to Let—or Hinder.** "Sparrow." A discussion of the problem of standardizing the cockpit arrangements of modern military aircraft. It indicates that only a certain amount of standardization is necessary and practical and offers a zoning method by which some form of general unification may be achieved. This includes grouping of instruments, interpretive design of lever knobs rather than a meaningless system, and similar improvements, the object being to aid the pilot in familiarizing himself with strange types of aircraft. *Flight*, January 1, 1942, pages 6–9, 8 illus.

**Make Way for Tomorrow.** An attempt is made to look into the future of aircraft design, accompanied by pictures of several recent suggestions. *Air News*, March, 1942, pages 28, 29, 7 illus.

**German Aircraft Structures.** The first in a series of articles on the structural analysis of six types of German airplanes: the Dornier Do.17 reconnaissance bomber, the Heinkel He.-111K bomber, the Junkers Ju.87b and Ju.88 dive bombers, the Messerschmitt Me.109 and Me.110 fighters. This installment, describing and illustrating the wing construction, is supplemented by brief comparisons of what the designers have done and a few guesses why. *The Aeroplane*, February 13, 1942, pages 180–182, 15 illus.

**The Dornier Do.217E.** A detailed description of a German twin-engined all-purpose long-range bombing and reconnaissance airplane. Special features pointed out are that the engines are underslung, the nacelles extend backward a short way behind the wing, and the fuselage extends beyond the tailplane. *The Aeroplane*, February 13, 1942, page 183, 2 illus. Also *Flight*, February 12, 1942, pages 131, 134f, 1 illus.

**German Aircraft Structures.** The second and concluding installment on the structural analysis of six German airplanes—the Dornier Do.17, the Heinkel He.111K, the Junkers Ju.87b and Ju.88, the Messerschmitt Me.109 and 110—is devoted to descriptions of the fuselages. The processes of wing attachment are discussed and illustrated and comparisons are made on general points. *The Aeroplane*, February 20, 1942, pages 207–209, 6 illus.

**Modelers Mold Our Fighting Planes.** David Johnson. The services performed by young men as aircraft model makers at the Langley Field Experimental Laboratory are set forth, with information on the requirements for employment in this work. Many of these craftsmen, rated by civil service authorities as Under Aircraft Modelmakers, started their careers by making toy models. *Model Airplane News*, April, 1942, pages 6, 7, 57–59, 62, 64, 10 illus.

**Tailless Technique.** Manxman. A reply to a letter, published in a previous issue of *The Aeroplane*, which criticized the tailless airplane. It answers the objections point by point, with information about the construction and performance of this type of aircraft. *The Aeroplane*, February 20, 1942, pages 210, 211, 6 illus.

**The Body, the Soul, and the Airplane.** Wolfgang Langewiesche. An analysis of the effects certain improvements would have upon widespread public acceptance of the airplane intimates that such betterments are necessary for the airplane to become generally useful or even to reach its full value as a weapon. Comfort, simplification, and safety are the bases of the suggested improvements. For a better adaptation of the airplane to its users, the article contends, the obstacles to be overcome are simply more neglected than difficult. *Air Facts*, March, 1942, pages 29–48.

**Tactical Requirements of Fighter Design.** M. P. Stroyev. An exposition of the Russian position on fighter airplane design, taking the point of view that three types of fighter craft are needed: extremely high-speed single-seaters; lower speed, more maneuverable craft; and twin-engined long-range escort fighters. Other tactically dictated considerations affecting fighter designs are also presented. *Aeronautics*, February, 1942, pages 61–63, 4 illus.

**Was This the First?** Theodore P. Wright's letter to the publishers of *Flight* tells of a United States patent granted to him in 1933, following its filing in 1929, covering an asymmetric airplane design with the engine mounted in the left wing, which is longer and thicker than the right wing. Its weight is counterbalanced by the increased lift of the larger wing and the offset thrust of the engine is counterbalanced by the increased drag of the thicker wing. *Flight*, February 5, 1942, page h, 1 illus.

**A Study of Tailless Aircraft.** Raoul Hoffman. Including a brief discussion of the Northrop flying wing, this is a general survey of the trend in tailless aircraft. *Flying and Popular Aviation*, April, 1942, pages 45, 102, 104, 32 illus.

**Design for Repairing.** James E. Thompson. It is stated that the development of military airplane designs requires that the general phases of structural repairs be considered from the beginning of every design. The basic structure should be planned during preliminary design investigations to provide for a structural layout that is more simple to repair. Factors to be considered and the procedure to be followed for repair are covered. *Western Flying*, March, 1942, pages 44, 46, 48, 4 illus.

## Engines

**More Air Power for Britain.** Gordon Sear Williams. A presentation of the Bristol Persues and Hercules sleeve-valve type radial engines, giving their history, details on their construction, their limitations, and some of the advantages they are supposed to have over the convention radial equipped with poppet-type valves. *Air Trails*, April, 1942, pages 11, 42, 44, 3 illus.

**Shock Dampers.** A study of the results of tests on the effect of adding dynamic dampers to the crankshaft of a six-in-line deHavilland Gipsy engine. The article explains the theory of the dampers and their practical results in reducing torsional vibration and interprets the records of the tests

run on the Gipsy engine. *Flight*, January 8, 1942, pages b–d, 5 illus.

**Power Plus: How Whirlwinds and Cyclones Are Made.** Numerous pictures enable the reader to visualize the process of manufacture of the Wright aircraft engines, emphasizing the precision methods followed. *Air News*, March, 1942, pages 18–21, 36 illus.

**Dynamometers for Testing Engine Ratings.** P. G. Lessman. The characteristics of some recent large dynamometers are treated, with information on the problems encountered in meeting the severe requirements imposed by high-powered aircraft engines and the means for correcting errors that are possible in such operations. *Aviation*, March, 1942, pages 87, 89, 2 illus.

**Aircraft Speed Dependent upon Engine Characteristics.** W. Stepniewski. This discussion deals with the connection between the general lines of engine development and the problem of higher speeds. It also establishes some simple formulas expressing the dependence of speed upon such engine characteristics as the ratio of weight to power and the altitude for maximum power. Diagrams and mathematical calculations are included. *Aero Digest*, March, 1942, pages 214, 216, 218, 312, 313, 5 illus.

## Flight Technique

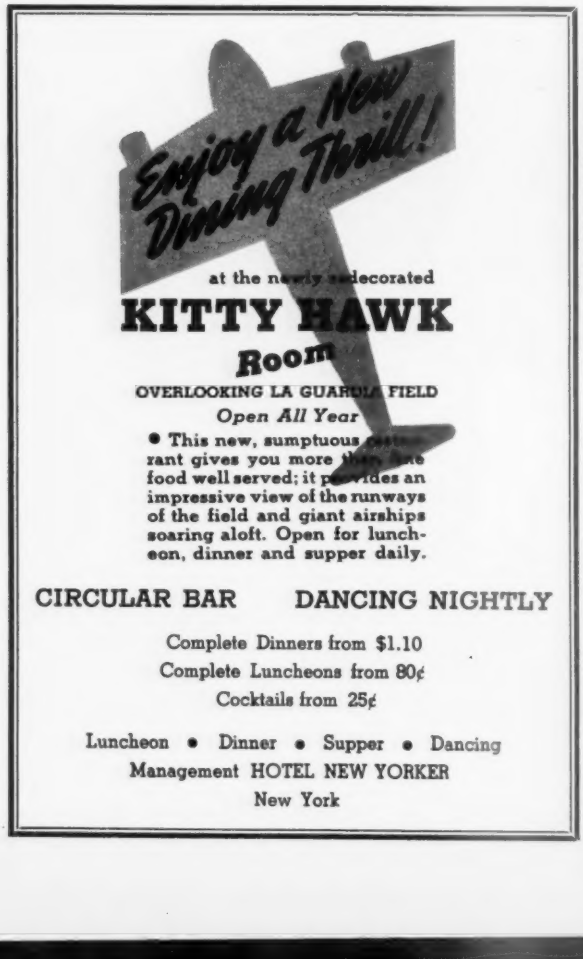
**A Kinetic Energy Correction to Predicted Rate of Climb.** Frederick C. Phillips. The assumption of zero acceleration along flight path, generally made in the interest of simplification in climb performance calculations, is pointed out, and the general performance equation is restated for the case of finite acceleration. This assumption is shown to result in optimistic rates of climb. The percentage error involved is analyzed and shown to increase rapidly with airplane loading and with altitude, particularly in the stratosphere.

The war emergency is accelerating tremendously the trend toward higher operating altitudes and higher loadings for military aircraft. Increasing climb errors involved by these trends will shortly be of appreciable magnitude. This case of a high-altitude bomber is given to illustrate quantitatively. It is recommended that allowance be made, in establishing climb performance guarantees and in correlating computed and flight rates of climb, for the error incurred by assumption of zero acceleration along the flight path. *Journal of the Aeronautical Sciences*, March, 1942, pages 172–174, 3 illus.

**Handling Monoplane Bombers.** Gordon H. G. Garbett. A discussion of the practical problems of handling modern bombing aircraft. This individual treatment gives general cockpit procedure, studies in stalling and spinning tendencies, the use of trim tabs, and the effect of adverse weather conditions on piloting. *Aeronautics*, February, 1942, pages 46, 47.

## Gliding and Soaring

**Glider Performance Calculation.** Keith W. Turner. This article describes a method that has been devised for doing quickly and without arithmetical drudgery the aerodynamic calculations necessary in the evolution of gliders to fit new operational requirements. The method takes into account the glider's weight, span, aspect ratio, parasitic drag, wing thickness, taper and twist, and wing section characteristics. The effects of varying one or more of these factors can be rapidly determined, and the process of assessing the relative merits of alternative wing sections is considerably facilitated. Practical directions are given, followed by a theoretic discussion. *Aircraft Engineering*, February, 1942, pages 47, 48.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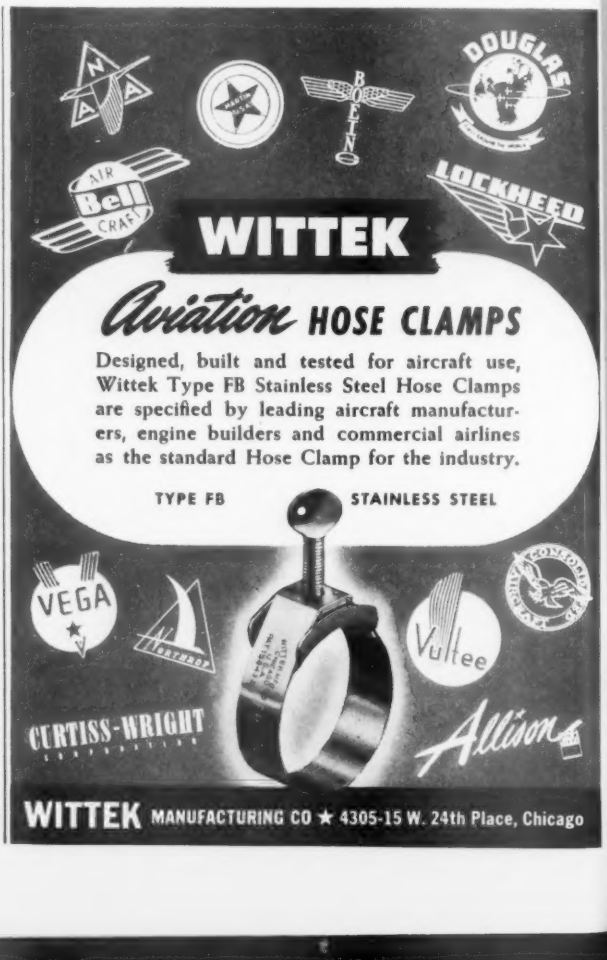
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## High Altitude Flying

**De Strijd om de Hoogte (The Struggle for Altitude).** A comparison of the ceiling achieved by military airplanes of World War I and II. With the development of greater power in aircraft engines, the ceiling was increased steadily. However, for the past ten years the service ceiling for bombers has been maintained at 5,000 m., but it is now indicated that they will in the future fly 20,000 m. above the ground. *Vliegwereld*, January 15, 1942, page 778.

## History

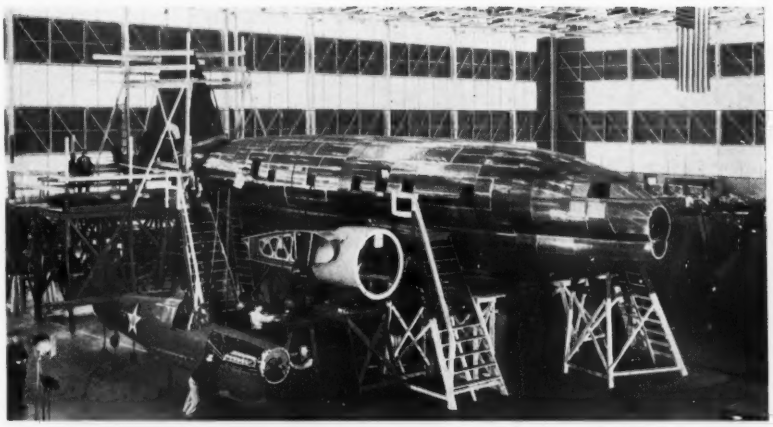
**First War Time Meeting of the Institute of The Aeronautical Sciences.** With primary emphasis on the problems of production, the wartime status of the industry was reflected in the papers presented at the Tenth Annual Meeting of the Institute of the Aeronautical Sciences. Major activities at the meeting are related in text and sketches of some of the leaders in the field are reproduced, as well as photographs of the bestowal of some of the annual awards. Within the limits of available space and the military restrictions, brief digests are presented of the content and conclusions of papers containing material of direct concern to the men engaged in the productive effort. A list of the titles and writers of all papers presented is included. *Aviation*, March, 1942, pages 66, 67, 204, 205, 14 illus.

**1941 in Retrospect.** A summary of the successes and defeats of British air power during 1941, offering an outline and results of the campaigns in Greece, East Africa, the Middle East, and the sweeps over Germany, as well as the direct defense of the British Isles. *Flight*, January 1, 1942, pages b–g, 18 illus.

**The Wichita Story.** Henry J. Allen. Since the entire February issue of *Southern Flight* is devoted to the city of Wichita, this chronicle, written by a former Governor of Kansas, keys the following articles. It traces Wichita's affiliation with aviation from the beginning of the twentieth century until its present day place in the industry as the home of Boeing, Cessna, Beech, and Culver. *Southern Flight*, February, 1942, pages 21, 22, 45, 1 illus.

## Hydraulics

**Development of Hydraulic Pressure Regulators.** W. C. Trautman. Problems to be overcome and the methods used in designing and manufacturing hydraulic pressure regulators are taken up in this article, which includes information on practices to be followed in the production of such equipment. *Aero Digest*, March, 1942, pages 200, 202, 8 illus.



Completed fuselages of the Curtiss C-46 twin-engined transport and the P-40 Hawk, indicating the comparative sizes of both types which are completed in adjacent assembly lines.

## Instruments

**In Modern Aviation—Instruments Stand for "Flight Security."** Charles Clay. It is claimed by the writer that the precision of modern flight instruments is largely responsible for the record of safety in air transportation. The scores of "eyes and ears" that enable the pilot and crew to know exactly what is going on in all the complex parts of an airplane are explained in narrative form, as well as the duties and responsibilities of the small army of Canadian technicians employed by Trans-Canada Airways at Stevenson Field, Winnipeg, who make sure that those instruments are accurate and efficient. *Commercial Aviation and Aircraft Production*, February, 1942, page 58, 1 illus.

**Flight Instrument Standardization.** L. N. Swisher. Methods of instrument standardization developed by the Aeronautical Board in cooperation with the Sperry Gyroscope Company, Inc., and other manufacturers are recounted. The advantages of this program are the simplification of the manufacturing problem and the attainment of maximum interchangeability of parts, to facilitate repair and maintenance work. When specifications are determined and approved, they are given "A-N" (Army-Navy) numbers which serve as a basis for future procurement for the armed forces. The gyrohorizon indicator and the directional gyroindicator are illustrated. *Commercial Aviation and Aircraft Production*, February, 1942, pages 48, 52, 4 illus.

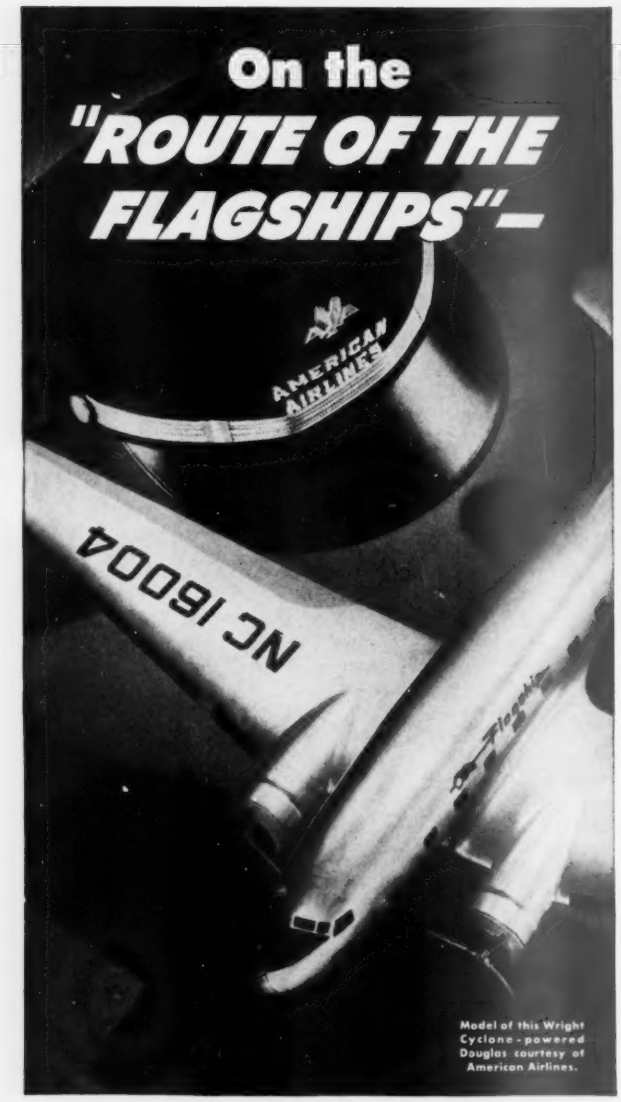
**A Device for the Continuous Indication of Oxygen Saturation of Circulating Blood in Man.** E. A. G. Goldie. The writer, who is a member of the Physiological Research Unit of the R.A.F., describes a device that gives a continuous indication of the oxygen saturation of the blood in the intact human subject by photoelectric measurement in two spectral regions of light transmitted through the pinna of the ear. It is shown that a close approximation to the arterial saturation is obtainable. *Journal of Scientific Instruments*, February, 1942, pages 23–25, 3 illus.

**Curtiss-Wright Tell-Tale Panel.** How Curtiss-Wright developed a simplified instrument panel for airplanes and the functions of the panel are reported, with information on the operation of the device and the benefits obtained in relieving the fatigue of pilots through facilitating their work. *Aero Digest*, March, 1942, pages 235, 236, 238, 311, 6 illus.

## Jet Propulsion

**Lunar Space Vessel.** R. A. Smith. The organizing secretary of the British Interplanetary Society discusses the possibility of a rocket flight to the moon, offering a suggestion for the design of the projectile, fuel, controls, releasing gear, and landing device. *Flight*, February 12, 1942, pages d–f, 6 illus.

**Thermal-Air Jet-Propulsion.** Gohlke. A comprehensive summary is presented of the existing patents dealing with the subject of thermal air jet propulsion. The history of numerous inventions is traced from early experiments in 1886 to date, showing the progress achieved and leading to the conclusion that the system is still only in the embryo stage but is approaching the threshold of usefulness. The opinion is expressed that the principle offers the ideal solution of the problem of increasing the speed of aircraft beyond 400 m.p.h. Sketches and descriptive captions are included showing numerous devices and their

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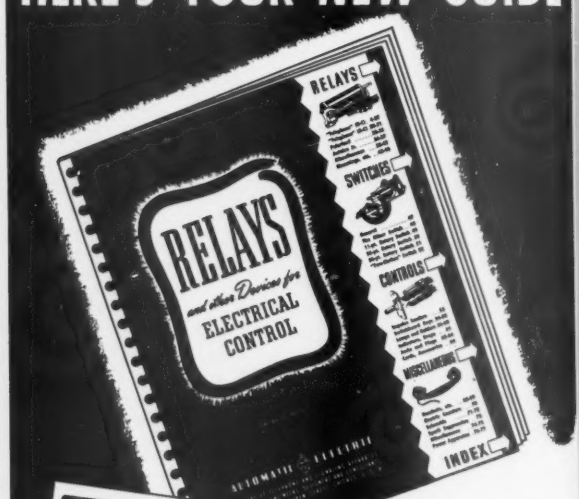

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component parts. *Aircraft Engineering*, February, 1942, pages 32–39, 42 illus.

## Maintenance

**Merlin Maintenance.** Part II. The concluding installment of details on the Rolls-Royce Merlin Engine covers supercharging, carburetion, fueling, and timing systems. *Canadian Aviation*, February, 1942, pages 39, 40, 80, 4 illus.

**Salvaging Worn Parts.** Practical methods for salvaging components that have become worn in service or improperly machined include electrodeposition, "fescolizing," bronze welding, and metal spraying. Details of these processes are set forth, with comments on their application and the results obtained. *Aircraft Engineering*, February, 1942, pages 53–55, 3 illus.

**Echelon of the R.A.F.** J. I. Waddington. How Great Britain has organized the work of wartime repair and maintenance of aircraft is related in a review of the activities of the coordinated military and civilian repair units. The methods and technique employed are comparable in essentials to those used on commercial airlines before the war but are greatly speeded up to include the maintenance of purely operational equipment, as well as the basic engine and airframe routines. One advantage of the "Echelon" system, as it is called, is the provision for moving a minimum amount of equipment when a squadron transfers its personnel from one station to another. Equipment used is standardized at all R.A.F. aerodromes, including kits of tools for each worker. Every possible part of a wrecked airplane is salvaged. The system has been extended to cover maintenance work on the United States aircraft, which are being received in increasing numbers. *Aviation*, March, 1942, pages 122, 123, 125, 4 illus.

**Maintenance Notebook.** A group of captioned pictures from various plants, hangars, and airports contains some suggestions for civilian and military maintenance men. *Aviation*, March, 1942, pages 126, 127, 10 illus.

**Preventive Maintenance to "Keep 'em Flying."** J. F. Martin. The superintendent of maintenance for the American Airlines tells how the airlines are trying to help government and industry in their transportation problems by making the best possible use of equipment on hand, by planning schedules to aid industry rather than vacationers, and by arranging overhaul procedures so that equipment is out of service for the shortest possible time consistent with good workmanship. He discusses the maintenance procedure followed by American Airlines, their overhaul system, and how apprentice mechanics are trained. *Aviation*, March, 1942, pages 129, 130, 202, 7 illus.

## Management

**Liaison Between Design and Production.** A. J. Schroeder. The benefits of efficient organization and close cooperation between those responsible for design and for production are brought out in the report of an investigation of the ten major causes of faults in production. The faults are classified into ten groups and suggestions are made for avoiding these faults. *Aircraft Engineering*, February, 1942, pages 57, 58, 2 illus.

## Medicine

**The General Mission of Military Aviation Medicine.** Col. David N. W. Grant. A discussion of the selection and care of flying personnel. In the selection of applicants for flying training, the writer states that the aim is to select only those who meet the high physical standards and the necessary psychologic qualifications to complete flying training and to withstand the "occupational stress" that will be imposed upon them by combat flying. The procedure to be followed in detecting flying fatigue and the prophylactic measures against its full development are outlined. *The Military Surgeon*, March, 1942, pages 281–290.

**Observaciones sobre Medicina de Aviacion (Observations on Aviation Medicine).** Raul Yazigi. The writer, a medical officer, tells of having taken a regular course at the Randolph Field Medical Aviation School. He gives a full account of this school and describes the procedure used in the fitness test for airplane pilots. *Revista de la Fuerza Aerea*, October-November-December, 1941, pages 18–24.

**"G" Men of the Air.** F. C. Sheffield. A study of the effect of acceleration on the human body in various positions indicated that the pilot can stand the longest period of violent acceleration without "blacking out" while in a prone position. The article points to the possibility of designing aircraft to permit the pilot to fly and fight from a ventral-prone position. *Flight*, February 12, 1942, pages g, h, 135, 3 illus.

## Metallurgy

**Aluminum Alloy Bead Proportions.** Edward J. Rantsch. The writer's experience is related in the proportioning of beads in aluminum alloy parts used in aircraft. Sketches and a tabulation of bead dimensions accompany this article. *Aero Digest*, March, 1942, page 209, 4 illus.

## Meteorology

**The Use of Three Dimensional Models for Classroom Demonstration.** Howard L. Stubblefield. Visual methods of presenting the various phases of meteorology in an accurate and easily understandable manner are presented. A description is included of the construction of a three-dimensional model of a wave cyclone now in use at Goodfellow Field, Texas, for the instruction of students. *Bulletin of the American Meteorological Society*, January, 1942, pages 34, 35, 1 illus.

**Use of Rossby's Trough Formula on the Mean 5-Day 3-Km. Pressure Charts.** H. Wexler. Methods and formulas for computing the velocity of waves of atmospheric pressure are discussed and tabulated. *Bulletin of the American Meteorological Society*, January, 1942, pages 32–34.

# Military Aviation

**From Farman to Taylorcraft Covers a Lifetime's Flying Experience.** Delivery of an undisclosed number of Taylorcraft O-57's to the Army Air Corps at Patterson Field, Dayton, Ohio, by a group of company pilots is related. The aircraft were flown from the plant recently by two groups of company executives, engineers, salesmen, and production men, one group headed by Chairman C. G. Taylor and the other by Richard H. Depew, Jr., Executive Vice-President and General Manager, whose flying experience is traced from his elementary training in 1911 at the Maurice Farman school in France. The airplanes were delivered in 15 days from the date of the Army's order, being essentially stock models which the Army will use as courier airplanes in cooperation with ground forces. *Commercial Aviation and Aircraft Production*, February, 1942, page 42, 2 illus.

**Vechten in den Nacht (Night Combat Flights).** Giving a comparison of the methods employed by England and Germany for night bombing flights, this description of ground organizations and of anti-aircraft defense shows that the greatest difference between the military operations of the two countries is that Germany transformed pursuit planes into bombers, while England made bombers to be pursuit planes also. *Vliegwereld*, November 20, 1941, pages 670, 671, 2 illus.

**Asi Nacieron los Famosos Stukas (How the Stukas Came into Being).** This brief historical sketch points out that the name of Mermann Pohlman will be permanently connected with the dive bombers Ju.87 and Ju.88. He is said to have conceived the idea and worked on it quietly for years before he showed the first plans of a dive bomber to Professor Junkers. The German army was very much interested in this aircraft and ordered a prototype that was built at the Swedish Junkers Works.

Demonstrations were made in Sweden and Russia by Director Achterberg. Again it took several years until the prototype could be brought to such a degree of perfection that it was accepted for service. It demonstrated its usefulness during the Spanish War.

As an interesting coincidence it is mentioned that the late General Ernest Udet had a similar idea at the same time. In his opinion the pilot of a bomber had to come so close to the object to be attacked that the maximum fire precision was assured. *Aeronautica*, November, 1941, pages 12, 13, 1 illus.

**Vertikale Umfassung (Vertical Outflanking).** Ernst Wyss. A Swiss army officer calls attention to the development of modern warfare by the use of parachute troops and air-borne troops. The training of the parachutists is shown to be more rigorous than that of any other branch of the service. The effective use of parachutists in the present war is demonstrated by the occupation of Oslo and Rotterdam airports and of the island of Crete, which are described in detail. According to the writer, the notion that the airplane is a weapon of destruction which will never make the occupation of the land possible is contradicted by the cases cited. *Schweizer Aero-Revue*, November, 1941, pages 15–19, 5 illus.

**Beschussfestigkeit von Junkers-Flugzeugen (Strength of Junkers Airplanes Against Shell Fire).** Hans Rudolf Burckhardt. Pointing out that the Junkers all-metal airplane dates back to 1916–1917 and was the prototype of all-metal airplanes, the writer states that after having undergone many improvements it is still almost unaffected by shell fire. A brief review of the most important characteristics shows that stresses and forces that act on wing unit, fuselage, and tail unit are carried jointly by the spars, bulkheads, and covering. If a spar is destroyed, the covering is sufficiently strong to prevent a fracture of the wings or of the tail unit. Fire hazard has been greatly reduced in all-metal construction. The inherent stability of modern airplanes is sufficient to keep the airplane flying, even if the elevator, the lateral control surface, or an aileron is put out of order. Many reports that heavily damaged Junkers combat planes have returned to their home bases are cited to prove how little they are affected by hits that would force other airplanes down. *Schweizer Aero-Revue*, November, 1941, pages 19, 20, 3 illus.

Final assembly of Lockheed *Hudson* bombers

**War Umpire.** Lt. Col. Roland Birnn. Relating the writer's experiences as an umpire during recent peacetime maneuvers, this is an account of air umpire procedure and the principles upon which it is based. It also points out the juxtaposition of the strict enforcement of war game rules with actual combat piloting. *Flying and Popular Aviation*, April, 1942, pages 32–34, 86, 88, 5 illus.

**Aircrew's Day.** In pictures and captions the activities of a typical day with the crew of an Armstrong-Whitworth Whitley bomber are shown. Many of these crews are composed entirely of noncommissioned officers. *Flight*, February 5, 1942, pages b–c,10 illus.

**Swarms of "Grasshoppers" Seen as U.S. Scorched Earth Weapon.** Irving H. Taylor. The secretary of the Aeronautical Chamber of Commerce of the United States, Inc., presents arguments in favor of the production and use of thousands of light planes for defense operations against enemy aircraft and ground forces. Swarms of "Grasshoppers" flown by the tens of thousands of Civilian Pilot Training Program graduates are visualized in a campaign of military action and to carry out a "scorched earth" policy against invasion. *American Aviation*, March 1, 1942, pages 8, 14, 6 illus.

**Hit or Miss—Is Aircraft Gunnery a Science or an Art?** Louis Bruchiss. An account of the performance of British aircraft gunners and anti-aircraft units is illustrated by numerous photographs and sketches. *Air News*, March, 1942, pages 8–12, 19 illus.

**A-20 Battle-Log.** Jack Buchtel. Originally designed as a light attack bomber, the Douglas A.20 bomber operates as an attack bomber, night fighter, interceptor, torpedo bomber, pursuit, long-range fighter, and reconnaissance plane. This is a description of the craft, showing the variable factors that make the chameleon-like changes possible, as well as a record of its performance. *Western Flying*, March, 1942, pages 27, 54, 1 illus.

**American Airplanes on the European Battlefronts.** Myles V. Cave. British opinion of U.S. aircraft is commented upon. The new equipment expected from America in early 1942 is outlined and some information is included on the performance of American aircraft by comparison with those of the Allied nations and the enemy on the various fronts. *Aviation*, March, 1942, pages 54, 55, 208, 209, 212, 5 illus.

**Light Planes at War.** William Strohmeier. A discussion of the usefulness of light planes to the Army, based primarily upon observations during maneuvers in the New Mexico area this past summer. Ruggedness, ease of maintenance, and the ability to land in a hay field are some of the advantages claimed for the "Grasshopper Squadron." *Aviation*, March, 1942, pages 138, 141, 184, 187, 188, 4 illus.

**They Learned About Parachuting from Us.** Alexander Barmine. This excerpt from a recent book, *Born to Be Free*, describes the origin of the Russian parachute troops. An emissar from the Russian Air Force, sent to observe air technique in the United States, reported the development of parachute proficiency to Russia, where it was applied to military purposes. During a demonstration of mass parachuting in Russia the idea was adopted by the Germans who promoted it to their own degree of efficiency. *Aviation*, March, 1942, pages 142, 143, 203, 3 illus.

**Progress of our Aviation Program.** Dow. W. Harter. The chairman of the special committee on aviation of the House Committee on Military Affairs reports on the progress made in the development, production, and delivery of aircraft to the British and United States air forces. It reviews the types of airplanes now in production and gives some instances of their performance. *Aero Digest*, March, 1942, pages 127, 306, 307, 3 illus.

## Naval Aviation

**Home Craftsmen Invited to Make Model Planes for the Navy.** Informa-

tion and instructions are given to amateur craftsmen to help them in applying their talents and equipment in furthering the national war effort. *Popular Science*, April, 1942, pages 79–80, 8 illus.

**Our Navy's Air Arm.** James L. H. Peck. Types of aircraft used by the United States Navy are reviewed, together with an account of the operations of our aircraft carriers. The training of naval aviators and gunners is also covered. *Scientific American*, March, 1942, pages 121–123, 3 illus.

**The Influence of Aircraft upon Naval Warfare.** C. P. Burgess. Reprinted from the same magazine for April, 1921, almost 21 years ago, for the accuracy of its prophecies, this discussion by the principal engineer of the Bureau of Aeronautics of the United States Navy reviews the ever present conflict of theories regarding the obsolescence of the capital ship. Pointing out that from the first use of shells against wooden ships to the development of the bomber and torpedo-carrying airplane as a destroyer of the large battleship there have always been counterdevelopments of new weapons, the writer indicated that the airplane would become a self-propelled projectile, operating from a capital ship such as an aircraft carrier, thereby facilitating naval operations at longer ranges than would be possible with the heaviest guns. He advanced the theory that naval engagements of the future would be decided by offensive operations against the enemy's aircraft carriers rather than by confining activities to shooting down waves of enemy airplanes. *U.S. Air Services*, February, 1942, pages 18, 21, 40, 1 illus.

**A Mass-Production Carrier?** Ben H. Pearse. Description of an invention for converting commercial vessels to serve as auxiliary aircraft carriers by means of a superstructure built of standard size oil well casings. Involving alteration of landing gear which is claimed to be slight, the innovation provides for a landing deck of parallel lines of oil well casing, $8^5/_8$ in. in diameter, spaced 3 ft. apart. Fifteen of these lines would make a landing strip about the size of a tanker's beam, but the structure could be extended to the desired size to fit any vessel. *Flying and Popular Aviation*, April, 1942, pages 37, 38, 104, 106, 3 illus.

**The Seadrome Lighting System.** W. A. Pennow. An explanation of the Westinghouse Seadrome Contact and Boundary Lights which provide directed fluorescent lighting, making night operations possible at marine bases. Details are given on the structure of the lights, the theory of operations, and their application. *Aviation*, March, 1942, pages 144, 145, 203, 3 illus.

## Parachutes

**Long Drop.** A. W. Bernsohn. To prove the practicability of free falls from the substratosphere for military applications Arthur H. Starnes made a successful test fall from an altitude of 30,800 ft. This is a record of the scientific preparations for compiling accurate data on the descent, the equipment used by Mr. Starnes, and his sensations during the drop. *Flying and Popular Aviation*, April, 1942, pages 46–48, 74, 76, 5 illus.

**Smoke Jumpers.** S. R. Winters. Particulars about the function and training of the parachute crews of the United States Forest Service. The article also points out how the peacetime training of these parachute troops skilled in the exploits of combating forest fires, dropping supplies and food in isolated areas, and rescuing snowbound people, forms a logical basis for transition to a military parachute guard. *Western Flying*, March, 1942, pages 36, 50, 3 illus.

## Personalities

**R.C.A.F. Personalities.** Biographic sketch of the senior organizational officer of the No. 4 Training Command of the R.C.A.F., Wing Commander C. F. Falkenberg. A former member of the famed first World War wing formed by Col. Bishop, Commander Falkenberg achieved 15 victories, winning the Distinguished Flying Cross and other decorations. *Air Force Review*, March, 1942, page 5, 1 illus.

**Here's My Story.** Lt. Gen. Delos C. Emmons. By means of sketches and brief biographic notes, the career of the head of the Army's Hawaiian Department is traced from his entry at West Point in 1905 to his appointment to his present assignment in December, 1941. *Popular Science*, April, 1942, pages 62, 63, 8 illus.

**Hawks Flew the High Ways.** Raymond E. Maher. An anecdote of the Albuquerque stopover on Captain Frank Hawks' record flight from Los Angeles to New York in his Travelair. *U.S. Air Services*, March, 1942, pages 25, 38.

## Personnel

**Personnel Safety.** The high degree of care being taken in aircraft and equipment plants to guard employees against accident and injury is set forth in a survey of several leading factories building airplanes, engines, and equipment. Safety devices applied to machinery and worn by the workers are shown, as well as the hospital equipment provided by various companies for use in case of injuries. *Aero Digest*, March, 1942, pages 93, 94, 99, 100, 103, 104, 109, 22 illus.

**Maintaining the Morale of Aircraft Workers.** An account is given of the steps taken in various leading aircraft manufacturing establishments to stimulate and maintain the morale of workers. Bonuses, merit awards, posters, suggestion boxes, forums, and get-together functions are only a few of the measures pursued. *Aero Digest*, March, 1942, pages 110, 115, 116, 121, 122, 10 illus.

## Plants

**Protection of Plants.** The most stringent system of protection ever devised for safeguarding a vital industry is described with as much detail as it is prudent to reveal under present conditions. That sabotage is only a remote possibility at any of our great aircraft plants is shown by this round-up of the measures taken for protection of the properties of several of the important makers of aircraft and equipment. Methods are discussed for keeping intruders out of the premises, fire protection, lighting, preparation for blackouts, handling of traffic, and identification of employees. *Aero Digest*, March, 1942, pages 77, 78, 81, 82, 87, 18 illus.

## Plastics

**Laminated Plastics Now Vital to Elimination of "Bottlenecks" in Production of Aircraft.** How laminated plastics as made by the Diamond State Fibre Company of Canada Limited have aided in the mass production of Canadian aircraft is related. Their properties make them particularly suitable for use in aircraft, being lighter than metals and adaptable to all machining operations, but they have many other applications. *Commercial Aviation and Aircraft Production*, February, 1942, pages 106, 108, 6 illus.

**Rolling Off a Log.** Thomas D. Perry. Properties of plywoods and applications of the material in the production of aircraft and other products are studied, with information on bonding agents and their uses. *Scientific American*, March, 1942, pages 125–128, 4 illus.

**Vliegtuigen van Kunsthars! (Airplanes Made of Plastics).** First installment of an article on the use of plastic resin glue in airplane construction, giving high praise to Harry Atwood, credited by the writer as the originator of this method. *Luchtvaart*, November, 1941, pages 431, 432, 1 illus.

**Without Priority.** This article examines the method by which the builders of the Langley monoplane use

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the plastic adhesive "Vinyl" in the construction of their all-plywood structure. *Flight*, January 8, 1942, page h, 3 illus.

**The "Baltimore" Mast.** The process of designing and testing a vital plastics part and then remaking it is demonstrated in this account of the development of the radio mast for the Martin 187, known to the British as the "Baltimore." Glenn L. Martin engineers cooperated with the plastics' manufacturers in the construction of the radio mast in molded-macerated and molded-laminated phenolic materials, realizing a structurally efficient, lightweight antenna support that has proved its worth in test flight and is being used in actual combat. The antenna tip and the tapered mast itself are combined in one integral unit. The base is of macerated fabric-base phenolic molding material with a five-layered laminated fabric preform molded into the material over the area of high-stress concentration. The mast proper is woven fabric wrapped on a streamlined tapered mandrel and impregnated with phenol-formaldehyde resin. The completed unit is designed to withstand the stresses of wind pressure up to 300 m.p.h. The methods of testing the new mast are described and illustrated. *Modern Plastics*, March, 1942, pages 39–41, 100, 102, 7 illus.

**Resin-Bonded Wood Laminates for Shell Type Aircraft Structures.** Alfred A. Gassner. A paper by the vice-president of engineering of Duramold Aircraft Corporation is introduced with brief remarks on the properties of wood and the statement that wood veneers in combination with synthetic resins are now considered as a suitable material for aircraft construction. A general discussion follows on wood laminates, taking up some of the objections offered by engineers to the use of wood—(1) that wood is not homogeneous and is not isotropic and (2) that it deteriorates under atmospheric conditions. These objections are answered in an explanation of the use of modern wood veneers plus synthetic resin products, making a material that is as homogeneous and as isotropic as is required and that is protected against deterioration from atmospheric conditions.

A mathematical analysis of three-ply panel for tensile stresses in the laminations is followed by a similar discussion of single veneer under tension stress and of three-ply panel in tension. Compression stresses are likewise treated mathematically, and the paper concludes with information on the application of stress data and methods to the design of aircraft structures. *Journal of the Aeronautical Sciences*, March, 1942, pages 161–171, 5 illus.

**Synthetic Resins in Construction.** Part I. This is the first of two articles explaining the development of synthetic resins for aircraft structures. In this part the background for modern wood construction is given. The writer reviews briefly the research work and literature and examines the properties of resins as an aircraft material. *Aviation*, March, 1942, pages 84, 85, 3 illus.

# Production

**They Deliver the Goods.** Leo Patrick Murray. With Republic Aviation as the prototype, this article points out the extent to which subcontractors are employed in the production of airplanes. It reports a list of the parts that are farmed out for manufacture and describes the wide variety of shops that do the work. *Flying and Popular Aviation*, April, 1942, pages 26–28, 92, 94, 7 illus.

**Men and Machines.** Jack Frost. An analysis of the necessity of the wholesale conversion of industry to wartime production and what is being done along the lines of subcontracting. *Western Flying*, March, 1942, pages 28, 29, 52, 5 illus.

**Speeding Up Deep Drawing of Aircraft Parts.** Charles C. Misfeldt. The engineer who developed the process gives a complete description of what is said to be a revolutionary new method of forming aircraft sheet metal parts. This method is now being used on Vega production. The method is compared with the Guerin process, but further advantages are claimed to overcome some of the limitations of that process. In the Misfeldt drawing method the punch-press mechanism is used for driving the punch die against the work, but a movable base is used and multiple strokes are made by the punch. This makes it practicable to produce deep-drawn parts at relatively high speed, since suitable means are provided for restraining the die blank and controlling the punch so as to draw the material by easy stages. The equipment and operation of the press are detailed. *Aviation*, March, 1942, pages 64, 65, 203, 7 illus.

**Foundry Practice in Aircraft Engine Manufacturing.** H. G. Lamker. The foundry superintendent of Wright Aeronautical Corporation tells of the methods employed in the production and inspection of castings, pointing out the problems that were overcome and the ways by which the procedure was improved. *Aero Digest*, March, 1942, pages 221, 222, 302, 8 illus.

**Fleetwings Tools up for Mass Production of Parts.** The resourcefulness, modern management, experience, and the will to do a large job as fast as possible are recounted in this review of the activities of Fleetwings, Incorporated, which has compiled an outstanding production record in the past two years. The steps taken toward improvement in the operations of the plant are detailed, together with information on the training of personnel. *Aero Digest*, March, 1942, pages 231, 232, 305, 306, 7 illus.

**Methods of Template Reproduction.** Clarence O. Prest. Three methods are described for speeding up the processes of making templates from the original master engineering layouts. Each of these methods—the photograph, x-ray, and electrolytic—is outlined briefly, with a discussion of their advantages and disadvantages. *Aero Digest*, March, 1942, page 240, 2 illus.

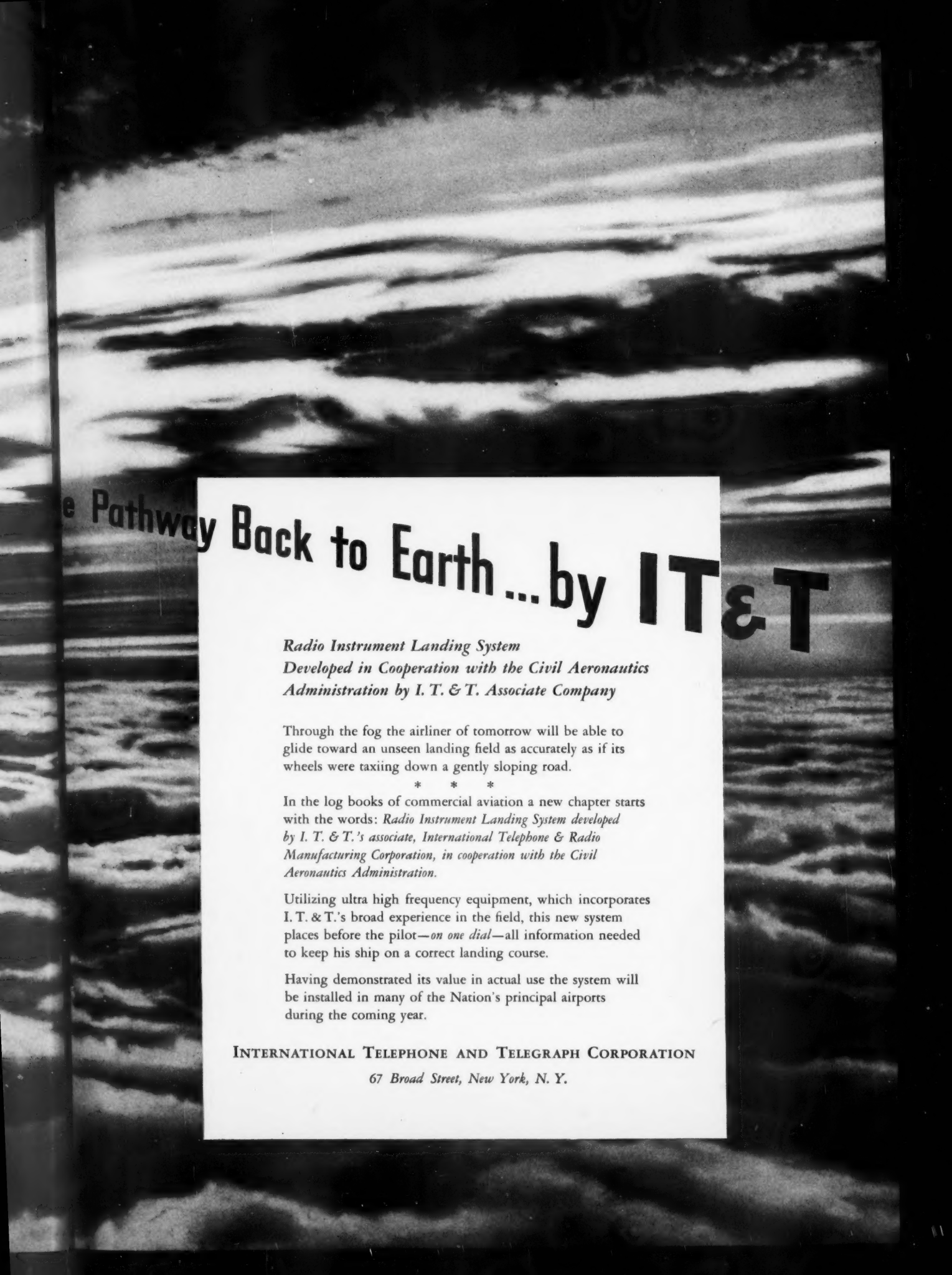
**Production Short-Cuts.** Equipment for expediting the handling of materials and parts in aircraft factories is described briefly under the headings of conveyer systems, heat-treating, rolling, bending, spraying, punches, metallizing, and other processes. The practices of numerous leading aircraft manufacturers are covered in considerable detail. *Aero Digest*, March, 1942, pages 253, 254, 257, 258, 263, 264, 268, 271, 272, 276, 280, 282, 284, 288, 291, 292, 297, 301, 38 illus.

## Propellers

**Aluminum Propeller Blades Manufactured in Montreal by "Canadian Car."** An account of the production processes involved in the manufacture of aluminum alloy aircraft propeller blades. These blades are part of the Hoover Hydraulic Propeller developed by Canadian Car. *Canadian Aviation*, February, 1942, pages 47, 48, 50, 8 illus.

**El Equilibrado Dinamico de las Helices (The Dynamic Balance of Propellers).** Juan Wiener. Some time ago the writer presented in this periodical an article on the balancing of propellers. In the present study he treats the dynamic balance of propellers mathematically. *Aeronautica*, November, 1941, pages 36–38, 3 illus.

**The Rotol Contra-Rotating Airscrew.** What is claimed to be the first feathering "constant speed" counter-rotating propeller is described, a product of Rotol Airscrews Ltd. How the counterrotating propeller has overcome the difficulty of efficiently converting engine power into thrust, elimi-

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is America invincible.

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nating automatically the effect of torque reaction on the aircraft, and neutralizing swing at take-off are indicated. *Aircraft Engineering*, February, 1942, pages 42, 43, 1 illus.

**Controllable Pitch Propellers for Light Airplanes.** Walter E. Burnham. The requirements for propellers for Wright airplanes are analyzed from the standpoint of cost and weight. Information is given on the performance requirements. The characteristics of fixed-pitch propellers and controllable-pitch propellers lead to the conclusion that the controllable-pitch or constant-speed propeller opens the door to advances in airplane and engine design. *Aero Digest*, March, 1942, pages 224, 226, 228, 8 illus.

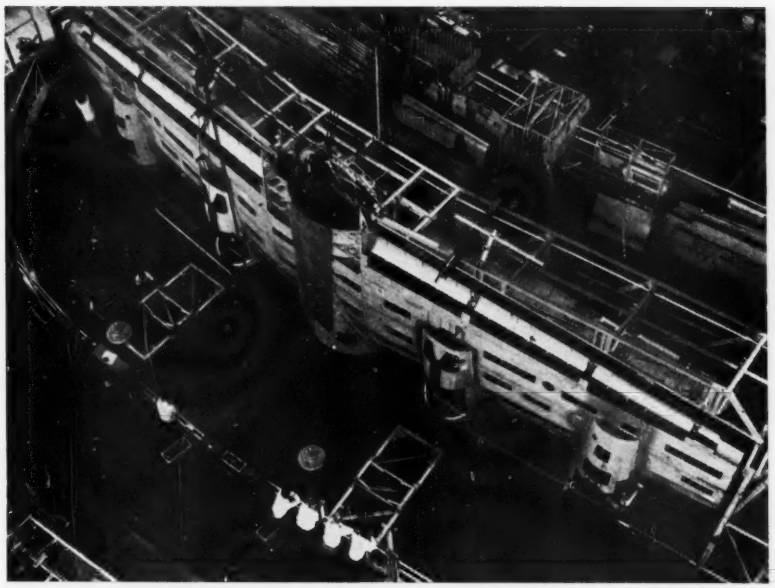
**Quality Control of Hollow Steel Blades.** H. P. Reiber. Processes in the design and manufacture of Lycoming hollow steel propeller blades are detailed, with information on the stresses to be met and the solutions of the problems involved. This paper, delivered at a special meeting of the Institute of the Aeronautical Sciences at Philadelphia, tells of the methods worked out for determining the ratio of strength to weight, blade thickness, torsional stiffness, and other factors. Manufacturing processes are described and illustrated, including the selection of materials and operations in machining and shaping the blades, which are inflated with inert gases under high pressure while being formed in the press. Methods of finishing and testing are also shown. *Aviation*, March, 1942, pages 68–71, 196, 197, 15 illus.

**Airscrew Performance Estimation.** A review of a report on the work of the deHavilland Aircraft Company, Ltd., in the calculation of the performance of propellers. *Aircraft Engineering*, February, 1942, page 39.

## Radio

**A Note on the Occurrences of Auroras, Temperature Changes and Radio Reception.** Harlan True Stetson. Observations on temperature and other atmospheric conditions at stations in vicinities where displays of the aurora occurred between January 1, 1936, and December 31, 1939, are made the basis of a discussion of auroral effects on radio reception. *Bulletin of the American Meteorological Society*, January, 1942, pages 21–23, 1 illus.

**Airway Radiorange Development.** David S. Little. Recent developments in airway navigational radio devices are reviewed, with comments on possible further progress after the war or as a result of war experience. One improved airway radio-range facility is said to be within reach, its development being complete although production, installation, and operation are still to be accomplished. This is the two-course, visual, quadrant-identified ultra-high frequency range, whose advantages and disadvantages are discussed in the light of prevailing conditions. *Aero Digest*, March, 1942, pages 66, 67, 413–415, 6 illus.



Assembling the center-section of the Douglas C-54 four-engined transport.

## Research

**A Million for Research.** Edward Churchill. A comprehensive interpretation of the nonaerodynamic research work being done by the Lockheed Structures Laboratory and some of the problems upon which it is engaged. This research is classified into the following four groups—mechanical, structural, production, physical, and chemical—and a description of the physical construction of the laboratory is given. *Flying and Popular Aviation*, April, 1942, pages 50–53, 78, 81, 13 illus.

## Stress Analysis

**Strain Energy.** H. Parkinson. The complete or firm structure is one with just sufficient members to keep it rigid under any well-defined system of external loading, and the forces in the individual members may be directly found by any of the methods usually applied to statically determinate structures.

When the number of members is in excess of that required for the firm structure, it is statically indeterminate or redundant, and the *strain energy* is a method used for solving the various forces. Other variations of the subject title are "Elastic Strain Energy" or the "Theorem of Least Work," the latter being a description of Castigliano's second theorem.

Because of the redundancy of the aircraft structure under the varying conditions of external loading, it is necessary to trace the forces in the alternative load paths for two purposes. The first is to determine the maximum forces in the structural members when the sizes are known; the second is to use to the fullest extent in design the members primarily introduced to meet a particular form of loading. *Flight*, December 25, 1941, pages 471–473, 5 illus.

**Aircraft Sections.** A study of the importance of torsional, as well as flexural, rigidity in steel, aluminum, and magnesium alloys. Formulas for the design of aircraft sections, incorporating flexural and torsional factors, are given. *Flight*, January 8, 1942, pages 34–36, 7 illus.

**Buckling of the Circular Plate Beyond the Critical Thrust.** K. O. Friedrichs and J. J. Stoker. In this paper a complete mathematical solution of the problem of the buckling with large deflections of a thin circular plate under uniform radial pressure is given, assuming radial symmetry. Buckling takes place as soon as the prescribed thrust $p_a$ at the edge reaches a certain critical value $p_e$. Thin plates do not, however, fail if the thrust $p_a$ is increased beyond $p_e$. It is of importance, then, to determine the stresses when the ratio $\Lambda = p_a/p_e$ becomes greater than unity. This problem, which is a nonlinear one, is solved by two methods for finite values of $\Lambda$; also an asymptotic solution is given for the limit state when $\Lambda$ tends

to infinity. The most notable single result is that the membrane stresses for the large values of $\Lambda$ become tensions in the interior of the plate and change abruptly to compressions in a narrow "boundary layer" at the edge of the plate. Curves showing the behavior of the deflection and the stresses are given for a series of values of $\Lambda$. Some curves show clearly, in particular, that the limit state is approached quite closely for relatively small values of $\Lambda$, *i.e.*, $\Lambda > 5$. In closing, the writers discuss the relation between their results and von Kármán's theory of effective width for the buckling of rectangular plates. *Journal of Applied Mechanics*, March, 1942, pages A-7–A-14, 8 illus.

**The Lateral Instability of Unsymmetrical I Beams.** H. N. Hill. An expression is derived for calculating the critical bending moment at which lateral buckling will occur in an I beam which is unsymmetric about the principal axis normal to the web. The expression is derived for the case in which the beam is subjected to pure bending. This problem differs from the similar problem involving the buckling of beams of symmetric I cross-section in that the shear center of the section does not coincide with the center of gravity.

Experimental verification of the expression is obtained from the results of tests made to study the lateral buckling of unsymmetric aluminum alloy I beams under pure bending. *Journal of the Aeronautical Sciences*, March, 1942, pages 175–180, 3 illus.

**A Short-Gauge-Length Extensometer and its Application to the Study of Crankshaft Stresses.** C. W. Gadd and T. C. Van Degrift. The mathematical methods of determining elastic stresses in machine elements, particularly those of irregular contour, may be excessively complex, so resort is frequently made to approximate calculations that tend to lose accuracy while achieving simplicity. As a result, a constant effort is made to supplement the mathematical treatment with experimental methods of studying stress. In this paper the writers describe a short-gauge-length extensometer and explain its application in the determination of crankshaft stresses. This instrument meets the requirement of convenience in operation which is so essential in assuring that it will be used for the study of localized stresses. *Journal of Applied Mechanics*, March, 1942, pages A-15–A-20, 20 illus.

## Tools and Equipment

**A Simple Locating Clamp.** Description of a new Van-Leer panel and locating clamp for holding together two pieces of metal in the correct position for blind and ordinary riveting. Supplied in three sizes with different colored buttons for identification, this clamp can be inserted and removed with one hand and does not, according to its manufacturer, deform the inside of the rivet hole or scratch the metal. *Flight*, January 1, 1942, page 14, 1 illus.

# Training

**Aero Industries Technical Institute Launches New Training Scheme in Production Sciences.** Initiating a plan whereby a group of prominent aircraft industry executives will personally direct the operations of an aviation training school, the expansion project of the Aero Industries Technical Institute, Los Angeles, Calif., is outlined. Courses will be added in production procedure, including planning, operations analysis, plant layout, tool engineering, and time and motion study. *Commercial Aviation and Aircraft Production*, February, 1942, page 40.

**Some Meditations of a Wartime Elementary Flying Instructor.** Contaire. The observations of a primary flight instructor on the character and handling of flying cadets, their actions, behavior, and permeability to flight knowledge. The course of primary flying, its effect on the character of the embryo pilot, and the finished products it sends to the advanced flying schools are discussed. *Aeronautics*, February, 1942, pages 20–23.

**A-t-t-e-n-SHUN!** William D. Strohmeier. A commentary on pilot training, emphasizing the precision methods of the Army and the high standards required for flight instructors in civil elementary flying schools. The writer, now qualifying at the Hawthorne School of Aeronautics, Orangeburg, S. C., relates the actual flight problems that are given and wherein the course differs from the old C.P.T.P. instruction. *Air Facts*, March, 1942, pages 11–19, 1 illus.

**Air Corps Screening Test.** Leighton Collins. An outline of the screening tests now being given as a basis for judging the aptitude of applicants for the Air Corps. Includes purpose and general description of the examinations in addition to sample questions. *Air Facts*, March, 1942, pages 22–28, 1 illus.

**School for Ground Crews.** Capt. R. E. Hollis. The Army training school for mechanics at Patterson Field has many specialized departments, the functions of which are outlined. Training period is approximately four months, with trainee working six hours a day at the job, then receiving two hours of classroom instruction. *Flying and Popular Aviation*, February, 1942, pages 34b, 34c, 34g, 4 illus.

**Navitrainer.** B. H. Pearse. Designed by Lt. Col. C. J. Crane, the new Navitrainer, a device for use in training military flyers, simulates flight navigation on the ground and gives students nearly all the elements of actual flight, including day and night navigation over water or land and even over overcasts where only radio bearings and celestial navigation can be used. Operational features of Navitrainer are detailed. *Flying and Popular Aviation*, February, 1942, pages 70, 104, 106, 2 illus.

**Ground Crews for the Navy.** How young seamen of the Navy are trained to become qualified aviation mechanics for the Navy's shore stations and the fleet is set forth in this description of the activities of the Aviation Machinist Mate School at the Jacksonville (Fla.) Naval Air Station. The men, mostly young recruits are given weeks of study of the techniques and fundamentals of aircraft construction and maintenance, after which many are sent to the station's assembly and repair shop to prove themselves by actual work. Then they go to their assignments as the ground crews of the Navy's fighting air squadrons. *National Aeronautics*, March, 1942, page 14, 2 illus.

**Een Nieuwe Grandtrainer (A New Ground Trainer).** Description of the new Crowell trainer and its development by its inventor, J. E. Crowell. *Vliegwereld*, December 4, 1941, page 698, 1 illus.

**Escuela de Aviacion (Aviation School).** D. Mujica. The establishment by a decree of the Chilean government, dated July 19, 1941, of an aviation school is recounted. This school will train flying cadets and is expected to be of immense benefit in improving the efficiency of the Chilean air force. *Revista de la Fuerza Aerea*, October-November-December, 1941, pages 25–28.

**Formacion de Operarios Especialistas para la Aeronautica Argentina (Training of Aeronautical Specialists in Argentina).** Edmundo P. Soulages and Juan A. Peretti. These writers emphasize the urgency of having specialists for aeronautical construction in Argentina. They present a program for a four-year training course for apprentices, giving the curriculum for each of the various specialized departments. *Aeronautica Argentina*,

January, 1942, pages 2097, 2098, 2101, 2146–2148.

**The R.C.A.F.** Don R. Rae. Some data on the growth of the Royal Canadian Air Force in the past two years as revealed by Squadron Leader Owen Cathcart-Jones, Staff Officer in the Directorate of Training. This brief discussion deals with the training of personnel and the development of the air force, air centers, and equipment. *Flying and Popular Aviation*, April, 1942, pages 42–44, 102, 4 illus.

**Wanted for the U.S. Air Forces, 125,000 Supermen.** Major Frank L. Nelson. A brief commentary on the program of physical development in force at the three Air Corps training centers at Maxwell Field, Ala., Randolph Field, Texas, and Moffett Field, Calif. *U.S. Air Services*, March, 1942, pages 15, 16, 1 illus.

**Pre-Training Program for Air Corps Flying Schools.** Dr. Herbert C. Mayer. Suggestions are given by the president of Parsons College for providing a reserve supply of flying cadets who will conform with Army Air Corps requirements. Described are schools for special supplementary pretraining to equip men whose qualifications are almost adequate but do not quite meet the educational or preparatory demands. *U.S. Air Services*, March, 1942, page 18.

**Radio Ground-Training Program for Student Pilots.** Ira V. French. The chief ground instructor of one of the leading British flying training schools discusses the procedure in the ground training of student pilots. *Aero Digest*, March, 1942, pages 128, 316, 317, 5 illus.

**Salvaging Aircrew Trainees.** James Montagnes. To make use of the many good men who for one reason or another have been eliminated as aircrew trainees, Canada has established the Composite Training School. This is an account of how unsuccessful aircrew men are given opportunities to train for other air force jobs with a subsequent salvaging of good soldiers and a saving to the R.C.A.F. of the money already spent on their training. *Aviation*, March, 1942, pages 136, 137, 197–199, 4 illus.

**Good Neighbor Pilot Training.** John McDermott. How the good neighbor policy is being implemented by Mid-Continent Airlines in offering pilot training to young men from Honduras is related in this report of the experiences of one of the students. *Airlanes*, March, 1942, pages 5, 21, 1 illus.

## Warfare

**British Coastal Command "Liberator" Has a Day's Work Ahead Every 24 Hours.** The pilot of a Consolidated four-engined Liberator in Great Britain relates his fights with two Heinkels, a German submarine, and a German battleship, all in 15 hours. *Commercial Aviation and Aircraft Production*, February, 1942, pages 33, 34, 5 illus.

**Civie Airmen and Allied Aircraft Blast Japs Out of Rangoon Skies.** William A. Hunter. Activities of a polyglot group of United States and British volunteer pilots are recounted in connection with the defense of Rangoon. A handful of intrepid civilians and a few of the fighting men of the R.A.F., equipped with such Consolidated Catalina, Brewster Buffalo, and other aircraft as could be spared from the services elsewhere, gave battle to large formations of Japanese invaders and turned them back time after time, often meeting odds of 8 to 1 and using individual fighting tactics reminiscent of the dogfights of earlier days. *Commercial Aviation and Aircraft Production*, February, 1942, pages 37–39, 9 illus.

**"Britain Calling."** J. Bradbrooke. Events of 1941 are reviewed from the standpoint of an observer of the British and Canadian contribution to the war in the air. Activities of various types of British, Canadian, and United States aircraft are recounted, covering the many fronts on which the war was prosecuted. *Commercial Aviation and Aircraft Production*, February, 1942, pages 44, 46, 68, 1 illus.

**One-Man Day Bomber.** W. E. Hick. A new idea in bombing technique, that of using a simply constructed single seater for roof-top level attacks is presented in this article. The airplane would be a single-engined craft, devoid of armament and all unnecessary weight, depending on superior speed and maneuverability for defense against balloon barrages, anti-aircraft fire, and hostile aircraft. *Aeronautics*, February, 1942, pages 26–28, 3 illus.

**Performance and the Night Bomber.** Capt. Norman Macmillan. An examination of the function of night bombers in modern warfare indicates how modernized defenses have made such improvements as increased load, climb, speed, and operation altitude necessary. *Aeronautics*, February, 1942, pages 35–37.

**How America Is Using Her Fighter Ships.** Carl Dreher. The different types of fighting aircraft used by the United States are described briefly and compared with the qualities of some British and German combat airplanes. Observations on performance and armament are also made. *Popular Science*, April, 1942, pages 54–59, 8 illus.

**La Guerra Aerea Ante el Derecho Internacional (Aerial Warfare in International Law).** Alfonso Santa Cruz Barcelo. Legal aspects of aerial warfare are reviewed, tracing the application of the science of aeronautics to warfare, when each belligerent nation made its own laws concerning it. Reference is made to the Franco-Prussian war when Bismarck informed the French government that occupants of balloons who flew across the Prussian lines would be treated as spies if captured. The Brussels Conference of 1874 rejected this theory, and the status of occupants of military balloons became that of combatants.

International law has kept step with the development of military aeronautics until the present war. Many unforeseen events have taken place, but the section of the 1921 Washington conference which prohibits the use of asphyxiating, toxic, and similar gases or of the use of bacteria is still respected. *Revista de la Fuerza Aerea*, October-November-December, 1941, pages 7–17.

**Aviacion de Asalto (Attack Aviation).** A paper read by Commandante Munoz of the Spanish air force on the tactical use of the dive bomber gives the main points to be considered in such operations, including the performance characteristics and armament of the aircraft used. The article mentions experiences with dive bombers and their effect in the Spanish War, with special reference to the Heinkel 51, and also methods of attack in groups whereby the individual bombers distribute their bombs over a certain territory. Other factors in attack flying are considered, as well as the use of air power in connection with naval craft. *Avia*, November, 1941, pages 245–250.

**Een Jaar Geschiedenis van een Heldhaftige Verdediging (One Year of Heroic Defense).** Since June, 1940, the island of Malta has been exposed to heavy air attacks, all of which to date have been successfully repulsed. Until June, 1941, there were more than 600 such attacks some of which this article describes in chronologic order. *Luchtvaart*, November, 1941, pages 435–438, 448, 4 illus.

**The Japs Are Vulnerable.** Leonard Engel. An appraisement of Japan's aeronautical weaknesses, of which the most important is considered the lack of aluminum. Other factors that give the United States a potentially decisive advantage, according to this article, are the shortage in modern power and machine tools, an absence of accumulated engineering knowledge, and the delays attendant upon launching the manufacture of radically new engine and plane types. *Flying and Popular Aviation*, April, 1942, pages 20–22, 82, 84, 5 illus.

# B.F. GOODRICH RUBBER RESEARCH FOR THE *Aviation industry*

## How Expander Tube Brakes improve a pilot's ground-control!

IN THE EARLY DAYS of flying, aircraft brakes were patterned after automobile brakes. They were heavy—brake shoe clearances were not uniform, leading to uneven wear and a tendency to grab. Repairs and adjustments were needed frequently.

When B. F. Goodrich developed the Expander Tube Brake, it was hailed as an important contribution to the entire aviation industry. Greatly improved controllability of planes taxied against cross winds . . . take-offs and landings that are safer, smoother, have resulted where planes are equipped with E. T. Brakes.

### How the E. T. Brake Operates

The Expander Tube Brake is attached rigidly to the wheel axle in service. It consists of a series of curved brake lining blocks that form a complete circle. These blocks are expanded radially to engage the inner surface of the brake drum, which is attached to the airplane wheel and revolves with it.

Immediately inside this circle of brake lining blocks, securely placed between the blocks and brake frame, is a flat band-shaped tube of synthetic rubber, reinforced with fabric. This is the B. F. Goodrich Expander Tube. The Expander Tube has a collapsed inner cavity extending across the entire tube which is connected to a hydraulic fitting.

Application of the braking fluid under pressure causes this B. F. Goodrich Expander Tube to expand uniformly under the full circle of brake lining blocks. When these blocks are forced against the revolving brake drum, the plane comes to a sure, smooth stop and completes the landing both safely and comfortably.

The B. F. Goodrich E. T. Brake is equally effective whether the plane is going forward or backward. This feature has proved especially helpful when the plane is parked.

The manufacturers of military and naval planes are specifying "B. F. Goodrich Expander Tube Brakes" in rapidly increasing numbers. More and more of the major air lines are demanding B. F. Goodrich E. T. Brakes on their transport planes . . . they are a favorite of light plane owners everywhere. The B. F. Goodrich Company, Aeronautical Division, Akron, Ohio.

**MAKERS OF B. F. GOODRICH TIRES AND OVER 80 RUBBER AND SYNTHETIC RUBBER PRODUCTS FOR AIRPLANES**

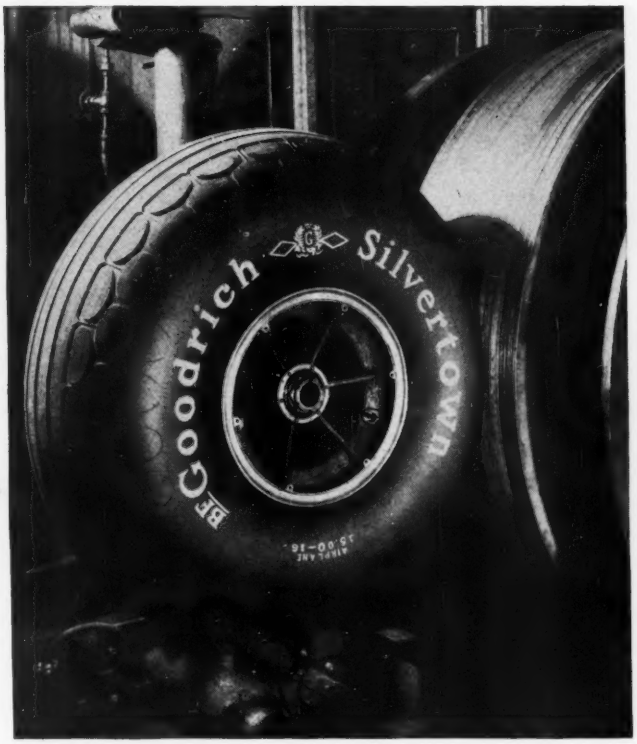
*Airplane landings inside a building make*

# SAFER LANDINGS OUT-OF-DOORS!

**QUICK PICTURE** of the Expander Tube principle. A rubber tube fills with fluid and expands. This presses the curved brake block units into contact with the brake lining. Contact is effected smoothly and evenly *all around* the brake drum.

* * *

**EXPANDER TUBE TESTER!** With wartime activity extended over areas ranging from great heats to sub-zero weather, a question of vital importance is "How does temperature affect the E. T. Brake?" To supply the answer to this, B. F. Goodrich engineers pioneered with this machine. An electrically heated coil was constructed with temperature controls between 70° F. and 800° F. To test for low temperatures, an ice bath was developed which had temperature ranges from 70° F. to 50° F. below zero. Pressure on the Expander Tube can be varied from 0 to 500 lb. per sq. inch. The never-ending search for aeronautical information such as this is what makes B. F. Goodrich truly "First in Rubber."



**BRAKE-TESTING MACHINE** developed by B. F. Goodrich engineers has not only been responsible for many improvements in E. T. Brakes . . . but was actually responsible for the development of the brake itself. Wheel and brake to be tested are attached to a swinging arm. Road wheel rotates at adjustable speeds and loads. Mounted tire is landed against rotating road wheel, thus simulating impact of a plane's landing. Brake is applied and instruments record pressure on brake, torque, and deceleration. This machine has been of extreme value in the development of safer, more efficient E. T. Brakes. A new brake-testing machine, the most modern ever built, is now under construction in the Goodrich laboratories.

*In war or peace*

**B.F. Goodrich**

**FIRST IN RUBBER**

Spot-welding aluminum alloy sub-assemblies at the Fairchild plant.

**The New Strategy of War.** Cy Caldwell. A commentary that the basic conception of armies and navies as a nation's chief defenders must give way to a new standard recognizing the importance of air power. Instead of the auxiliary capacity formerly delegated to it, adopting this standard would mean the recognition of air power as our prime martial factor with naval and land forces in supporting roles. *Flying and Popular Aviation*, April, 1942, pages 25, 58, 64, 68, 1 illus.

**An Argument for Torpedo-Carrying Seaplanes for Our Navy.** Considering the battleship versus torpedo-carrying seaplanes and presenting the advantages of the latter. These are based on the premise that the torpedo-plane method of attack eliminates the following six major sources of error which are incurred in bombing attacks: correct position of longitudinal axis of the seaplane, correct position of transverse axis, speed of the seaplane relative to air, speed of the air relative to the target, altitude, and personal error of the man who releases the bomb. *U.S. Air Services*, March, 1942, page 13.

**The War in the Air.** This twenty-eighth review of the war in the air on all fronts traces the action against the British ships "Prince of Wales" and "Repulse," in Malaya, and on the Eastern Front, noting the performance of the aircraft of the United Nations. It attempts to forecast future activities and the final results. *Aircraft*, January, 1942, pages 13–15, 34, 7 illus.

**R.A.F. Sunderland Crew Captures 100 Prisoners.** Pictures show the adventures of a British aircraft crew who escaped from their wrecked flying boat, which was brought down in the Mediterranean by two German fighters, and eventually reached their own lines with more than 100 Italian captives. *Air News*, March, 1942, page 6, 6 illus.

**Can Bombers Win?** T. Benson Hoy. Definitely advocating the negative side of this debate, the article contends that combat planes and not bombers decide victories in the air and, hence, on the ground. It points out why the strategy of long-range bombing is merely defensive and cannot produce victory if placed ahead of combat flying in military value. *Western Flying*, March, 1942, pages 24–26, 5 illus.

**America at War.** Starting with brief comments on the estimated strength of the Japanese air forces and the facilities of that nation for producing armament, the writer goes on to an evaluation of the production efforts of the United States. He outlines the objectives of this nation in equipment and man power. *Aviation*, March, 1942, pages 52, 53, 110, 125, 4 illus.

**Nazis May Lose Control of Air This Spring.** John A. Ward. The keynotes of the coming Battle of Europe are presented in this appraisal of the relative strength of the air forces of the Germans and the United Nations. The writer indicates the probability of a shift of aerial strength in favor of the Allies, coupled with the belief that Hitler will face an enemy with a superior number of tanks and armored divisions. The prediction is made that if everything goes as planned, the air power of the United Nations will become stronger and soon outnumber the Luftwaffe in airplanes and pilots. The writer concludes with the statement that in the long-range bomber and the medium bomber lies the greatest power that comes out of the skies, and it is in this field that the United States will deliver its hardest blows. The Royal Air Force and the Russian air force should also be well prepared for the test they will face this spring. *Aero Digest*, March, 1942, pages 60, 310, 311.

## Welding

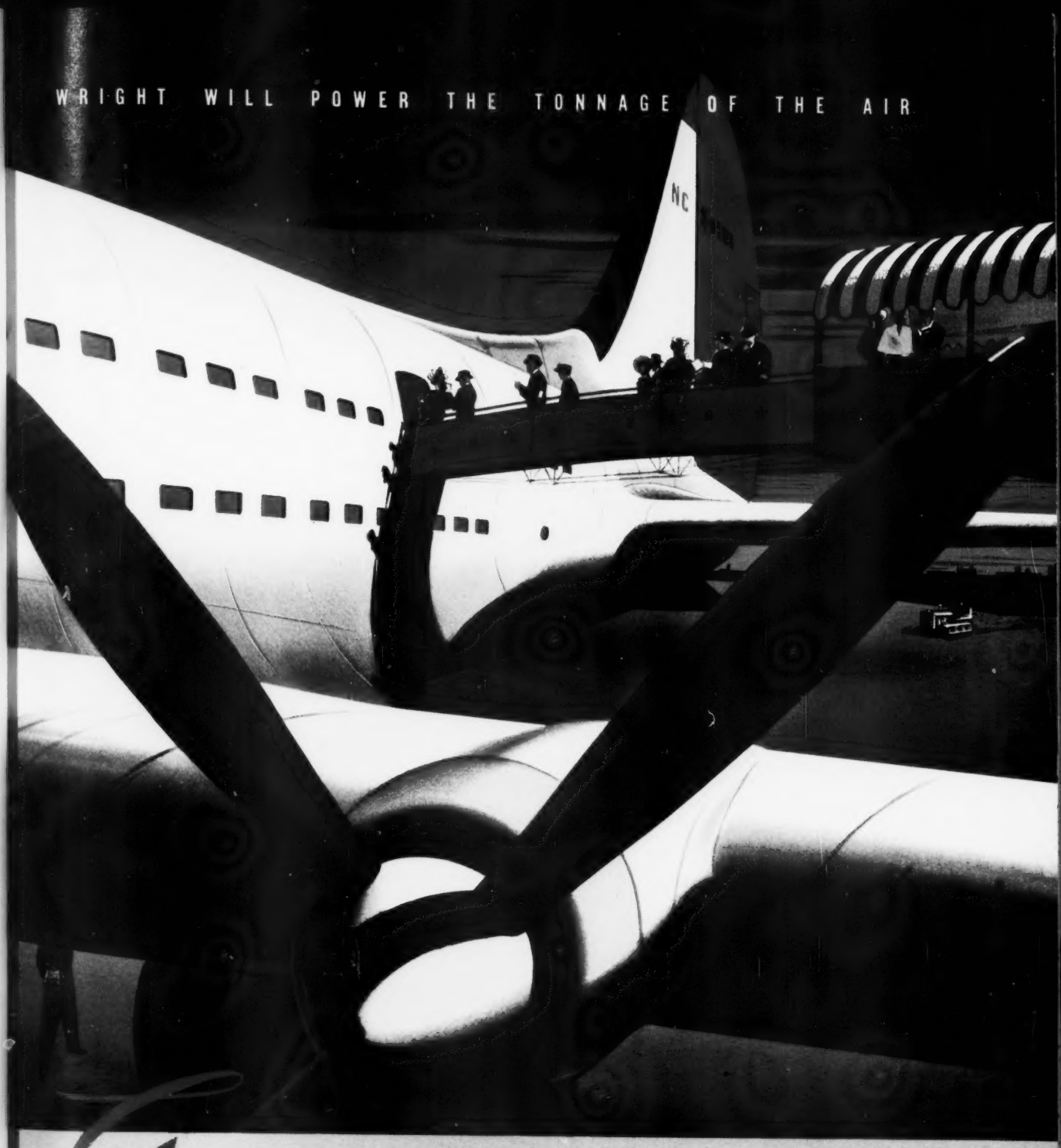
**Aircraft Welding—A Composite.** Various methods of welding, by gas and by the electric arc, are discussed with particular reference to the application of welding in the construction of aircraft. Information is included on spot welding and on the methods, technique, and materials used. *Metals and Alloys*, February, 1942, pages 298, 302, 304.

## Miscellaneous

**Recipe for Flight Photographs.** Rudy Arnold. What the successful aerial cameraman must have in the way of equipment, temperament, and knowledge is covered by one of the nation's foremost flight photographers. The importance of weather conditions, methods of determining exposures and placing the subjects in proper positions, ways to get "trick" shots, and some of the experiences of the writer are detailed. *National Aeronautics*, March, 1942, pages 20, 21, 3 illus.

**Visscheru Patrouille (Fishery Patrol).** McDonald White. An account of how the California Division of Fish and Game, in conjunction with the United States Coast Guard, sees to it that fishing along the California coast is carried out within the law. *Vliegwereld*, November 20, 1941, page 666, 1 illus.

**Brazil Fostering Air Expansion.** Alice Rogers Hager. This review covers the progress made in Brazil in military and naval aviation and also in civilian flying and commercial air transport. It covers the instruction given to military and civilian personnel and dwells upon the benefits that Brazil has received from the military missions that have visited that country from the United States. Brazil's airports and military fields are described briefly. *Aviation*, March, 1942, pages 56, 57, 180, 183, 184, 4 illus.




*Gangplank* TO THE AIR AGE

Aircraft engines are moving the world into the Air Age. Around powerplants now on the way will be built the giant transports of tomorrow. "Flying daycoaches", with the comforts of air travel, will cut time and distance for everyone. Wright's unsurpassed research and production facilities will supply the power for these sky-giants of the future.

WRIGHT *Aircraft Engines*

*Curtiss C-46 and P-40s fabricated with Boots Self-Locking Nuts*

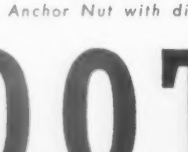
# HOW BOOTS NUTS HELP CURTISS "Keep 'Em Flying"

Keeping planes *in the air* is what counts today. Frequent repairs mean hours lost on the ground—and consequently a less effective fighting power.

To help turn costly repair hours into easy check-overs, Curtiss uses Boots Self-Locking Nuts. These longer lived fasteners reduce maintenance time because they need not be replaced. They are permanent—literally, they "outlast the plane."

In addition, Curtiss reduces weight on its new Cargo ship, the C-46 . . . and in one application, saves two precious assembly hours per pursuit plane because these Self-Locking Nuts, being all-metal, can withstand the intense heat necessary to bake the enamel on the tail surfaces of the famous Curtiss P-40.

*The Boots Aircraft Nut is the only all-metal, one-piece self-locking nut to pass the rigid tests of the Army, Navy, and Civil Aeronautics Authority.*

*Self-Locking Nuts for*  *application in all industries*

Cutaway of Boots Anchor Nut with dimpled rivet holes

# BOOTS

## AIRCRAFT NUT CORPORATION

NEW CANAAN, CONNECTICUT

# Government Publications

## National Advisory Committee for Aeronautics

**New Method of Extrapolation of the Resistance of a Model Planing Boat to Full Size.** W. Sottorf. A translation of an article entitled "Neues Verfahren der Ubertragung des Modellwiderstandes eines Gleitfahrzeuges auf die Hauptausfuhrung," from *Luftfahrtforschung*. The previously employed method of extrapolating the total resistance to full size with $\lambda^3$ (model scale) and thereby foregoing a separate appraisal of the frictional resistance was permissible for large models and floats of normal size. But faced by the ever increasing size of aircraft, a re-examination of the problem of extrapolation to full size is called for. A method is described by means of which, on the basis of an analysis of tests on planing surfaces, the variation of the wetted surface over the take-off range is analytically obtained. The friction coefficients are read from Prandtl's curve for turbulent boundary layer with laminar approach. With these two values a correction for friction is obtainable.

Worked-out examples indicate that resistance variations analytically determined and those derived from measurements give a practical approximation. A former scale series with the corrections applied to three resistance curves shows good agreement. The step from the 10-ton to the 100-ton flying boat with correction applied is found to be not critical for extrapolation from a model of customary size at the present time. *N.A.C.A. T.M. No. 1007*, March, 1942, 16 pages, 9 illus.

**The Stresses in Stiffener Openings.** K. Marguerre. Translation of an article entitled "Spannungen in Ausschnittversteifungen," from *Luftfahrtforschung*. As the initial step in the analysis of stress distribution in three-dimensional curved rings, as employed as stiffeners in stressed skin aircraft designs, the ring formed by the intersection of two circular cylinders is explored for three categories of load: tension in both cylinders, produced by hydrostatic pressure on the cylinder walls; axial force in the large cylinder; and, last, shear in the large cylinder. The discussion of these three load cases enables general conclusions concerning the behavior of the ring stressed by the shell forces and affords numerical data for the most important load categories obtainable from the computation by superposition. *N.A.C.A. T.M. No. 1005*, February, 1942, 26 pages, 15 illus.

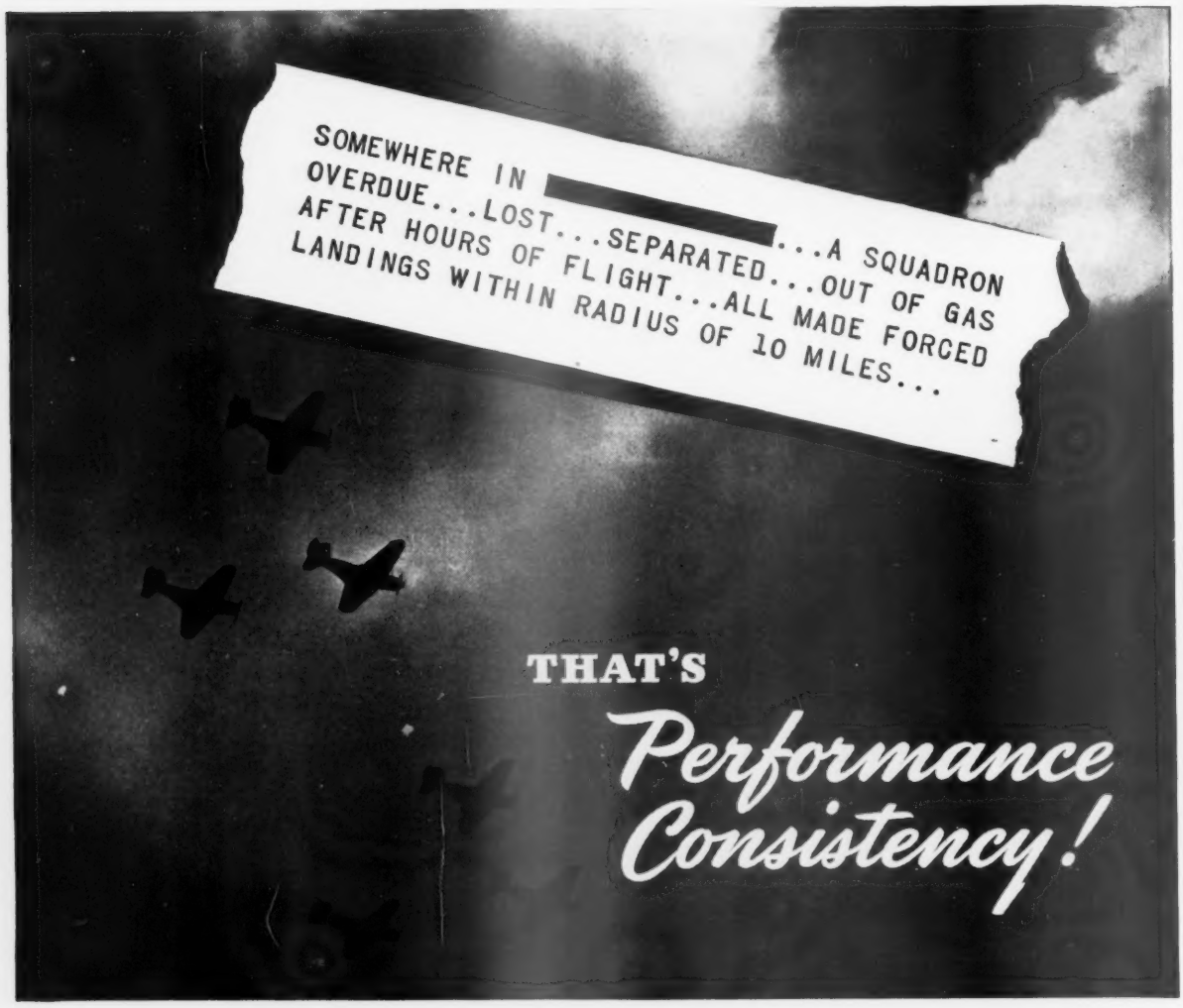
**Electrical Equipment for the Experimental Study of the Dynamics of Fluids.** Carlo Ferrari. A translation of an article entitled "Sistemazioni elettriche per lo studio sperimentale della dinamica dei fluidi," from *Societa Italiana per il Progresso delle Scienze*. This report contains the description of electric anemometers and their application to the study of turbulent fluid flows, of electric tanks for the realization of the analogies between electrology and aerodynamics and their application to the study of varied technical problems, and, last, of the electric condenser type dynamometer and its application to the prediction of the aerodynamic forces on wing and airplane models in wind-tunnel tests and in controlled and spontaneous rotations. *N.A.C.A. T.M. No. 1006*, March, 1942, 36 pages, 20 illus.

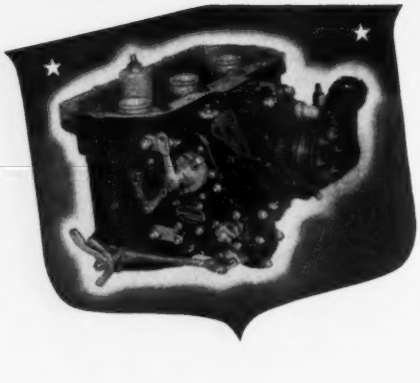
**Correlation of Data on the Statistical Theory of Turbulence.** K. Wieghardt. A translation of an article entitled "Zusammenfassender Bericht uber Arbeiten zur statistischen Turbulenztheorie," from *Luftfahrtforschung*. The statistical theory of turbulence affords an excellent medium for representing the kinematic conditions in turbulent flow and also serves as a valuable aid to exact experimental research. But it is still not developed enough for solving dynamic processes.

Even in the simplest case of isotropic turbulence the calculation of the correlation curve or of the decrement of turbulence invariably reaches a point where clear-cut assumptions—such as omission of the inertia terms or, earlier, mixing length assumptions or even merely general dimensional considerations—must be made. Since, on the other hand, the differential equations are simply evolved from Navier-Stokes and the continuity equations, it is safe to assume that in their multitude of solutions the actually arising relations are contained also. But there still is no physical principle with the aid of which the real solution could be dug out from the multitude of mathematically possible solutions. *N.A.C.A. T.M. No. 1008*, March, 1942, 20 pages, 5 illus.

**The Resistance Coefficient of Commercial Round Wire Grids.** B. Eckert and F. Pfluger. Translation of an article entitled "Bestimmung der Widerstandsbeiwerte handelsüblicher Runddrahtsiebe," from *Luftfahrtforschung*, April 22, 1942. The resistance coefficients of commercial types of round wire grids were examined for the purpose of obtaining the necessary data on supercharger test stands for throttling the inducted air to a pressure corresponding to a desired air density. The measurements of the coefficients ranged up to Reynolds numbers of 1000. In the arrangement of two grids in tandem, which was necessary in order to obtain high resistance coefficients, the relationship of the coefficients with the solidity, that is, mesh density of grid, was found to be accompanied by a further relationship with the mutual spacing of the individual grids. *N.A.C.A. T.M. No. 1003*, 11 pages, 7 illus.

**Statics of Circular-Ring Stiffeners for Monocoque Fuselages.** W. Stieda. A translation of an article entitled "Zur Statik von Kreisringspanten in Flugzeugdruckkabinen," from *Luftfahrtforschung*, June 30, 1941. For circular-ring stiffeners in monocoque fuselages, the bending moments, axial forces, and shear forces under the action of applied external forces or a moment are accurately computed by known methods. Circular-ring stiffeners with variable moments of inertia are likewise considered. In comparison with the step-by-step and partially graphical procedure, the one here described is a more accurate and at the same time a simpler method. *N.A.C.A. T. M. No. 1004*, 11 pages, 19 illus.



THIS actual occurrence (dates, locations, identification, must of necessity be withheld) affords a striking demonstration of the remarkable consistency of performance characteristic of Stromberg Injection Carburetion.

Fuel consumption is steady, predictable, and runs astonishingly true to form in like engines of like airplanes.

Other attributes of this modern carburetion are: automatic continuous self-adjustment to proper fuel-air mixture for all altitudes, employing fixed-size metering jets; very appreciable fuel economy; a resultant increase in the airplane's flying range and load capacity; simplification of field service work because of the virtually identical basic design used on various engine models.

BENDIX PRODUCTS DIVISION
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Stromberg ... A BENDIX PRODUCT

INJECTION CARBURETOR

## Civil Aeronautics Administration

**Fire Preventive Measures in Air Carrier Aircraft.** A primary report covering the research program being conducted by the Technical Development Section of the Civil Aeronautics Administration on fire prevention in airline equipment. The research indicates the necessity for providing a means for cutting off the flow of oil and inflammable fluids through the fire wall and to assist in the control and extinguishment of any fires developing in the engine compartment. The report indicates the type of cutoff and extinguishing equipment required for safe operation and offers notes intended for guidance in the design and installation of satisfactory safety devices. Extinguishing systems in the propeller feathering line and anti-icing and fuel systems are suggested. *C.A.B. Safety Regulation Release No. 96*, February, 1942.

**Amendments to Manual of Operations.** Amendments to the C.A.B. Manual of Operations containing phrase contractions for aircraft communicator and communication operator titles, conforming to the new complement structure and the new phonetic alphabet for domestic use. *Office of the Director of Federal Airways*, February, 1942.

## Civil Aeronautics Board

**Spring Weather.** Paul A. Gareau. The C.A.B. Safety Bureau's meteorologic specialist points out some of the extreme weather conditions which must be guarded against during the transition from winter to spring. Special regions where cyclones may occur, vigorous wind conditions, thunderstorms, and icing conditions that are usual at this time of year are indicated. *C.A.B. Safety Bulletin*, March, 1942.

**Aircraft Maintenance.** W. E. Koneczny. The purpose of this bulletin is to demonstrate to operators, mechanics, and pilots those parts of the airplane which appear to be responsible for most maintenance difficulties as reflected by the accident statistics gathered by the Safety Bureau. The bulletin indicates three definite classifications of accidents which are typical structural causes of trouble and outlines a general scheme of line inspection which, if followed, should substantially decrease maintenance troubles. *C.A.B. Safety Bulletin No. 113*, March, 1942.

**Aircraft Lightning Discharges.** A bulletin prepared by the Civil Aeronautics Board Safety Bureau outlining the conditions that are most likely to prevail at flight levels where lightning discharges occur, areas to be avoided in which lightning discharges

are possible, and procedures for pilots to follow in the event that they are in such a region. *C.A.B. Safety Bulletin No. 111*, March, 1942.

**The "Leans."** Harold G. Crowley. A study of "leaning," a false physical sensation or type of vertigo sometimes experienced by pilots during instrument flight. The report points out its manifestations and indicates some of the damaging effects that it may have on instrument flight performance of the individual pilot. Suggestions for overcoming this leaning tendency are offered. *C.A.B. Safety Bulletin No. 114*, March, 1942.

## Office of Civilian Defense

**Protective Concealment.** This booklet, prepared under the direction of the Chief of Engineers, U.S. Army, incorporating also the suggestions of the National Technological Civil Protection Committee, contains a compendium of both European and American methods of concealment of plants, airfields, and similar installations.

Basic considerations—such as the methods by which the enemy may attack, photograph, and make military observations, the elements of visibility, and the basis for concealment—are presented. Characteristic problems include methods for concealing small factories, larger flat plants, railroads, railroad yards and installations, airports, gas holders, and similar spots that might be bombing targets. The general theories of camouflage are explained, as well as some of the unusual procedures that may protect special installations. General information on the organization of entire communities for camouflage, the bombing methods against which camouflage would be effective, and other general information required for this type of passive defense are offered. One important point is made in the pamphlet. Because of the suspicion camouflage may arouse, no concealment may often be better than an ill-conceived job of camouflaging. *O.C.D.*, Washington, D. C., March, 1942, 68 pages.

## Office for Emergency Management

**Materials.** A study of the expansion of the nation's magnesium and aluminum production facilities made by William L. Batt, Director of Materials. It indicated that aluminum production from plants now in operation and scheduled to begin production soon will raise the total amount of aluminum available from domestic output and import to 2,500,000,000 lbs. upon completion of the program. Magnesium production of 400,000,000 lbs. a year would result from facilities now under construction, the survey indicated, and the objective is 725,000,000 lbs. a year.

The article outlines some of the fabricating and power problems and indicates some of the hitherto untapped sources of light metal ores which are being harnessed for the war effort. *Victory*, March 3, 1942, page 4.

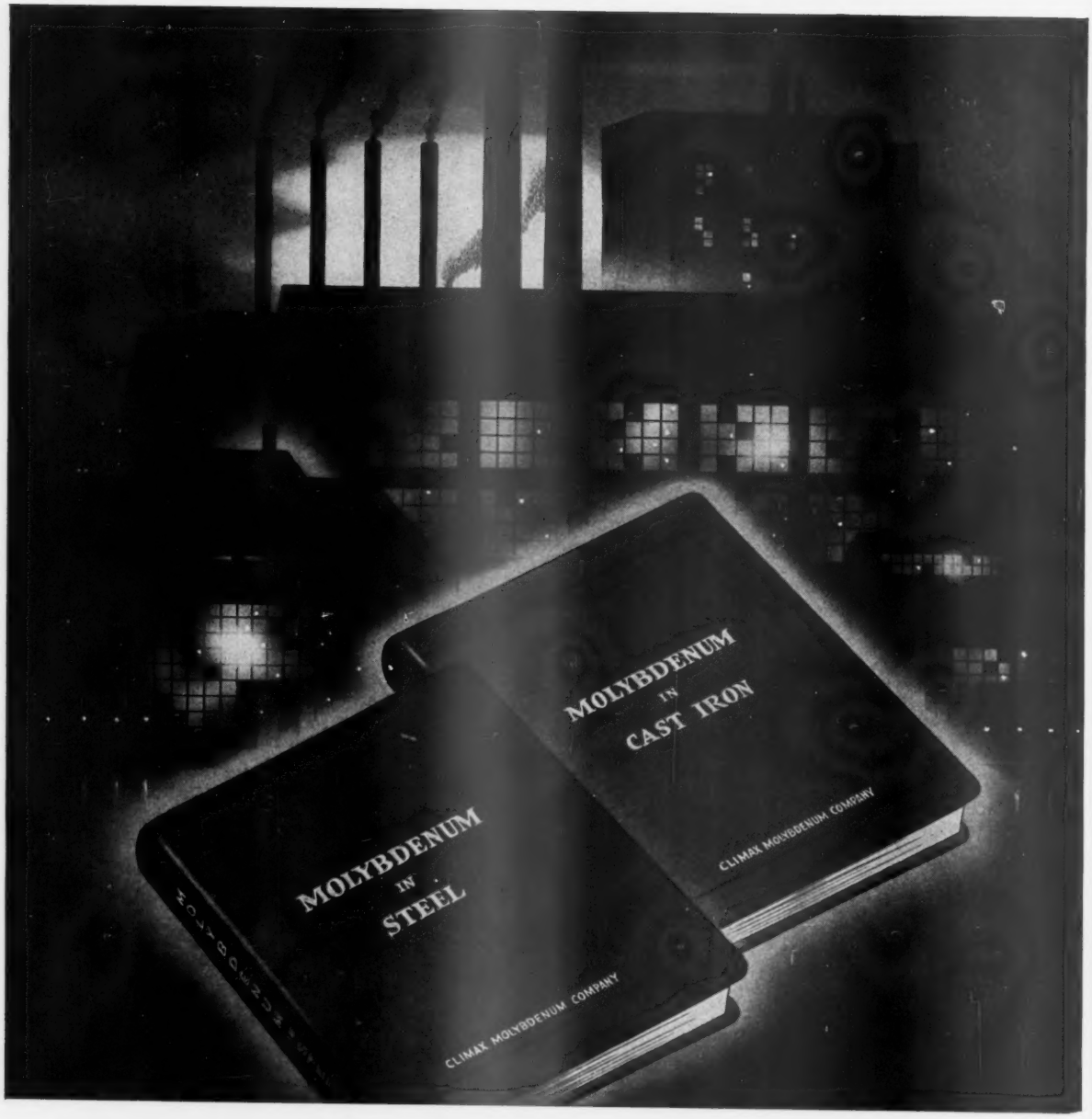
## British Library of Information

**Britain's Low-Level Bombing.** A report on the technique of the Royal Air Force in bombing important objectives from low level with perfect accuracy. Although, it is stated, the Nazis have never been able to emulate this technique against the British Isles, it has resulted in effective raids at the heart of Germany's war effort. Examples of vital points successfully bombed by this method are given. *War in Pictures.*

**Air Highways of the Future.** Quoting a recent speech by the Under-Secretary of State for Air to the effect that war has not killed civil air communications but has only diverted them to war service, the benefits to be derived after the war are explored. The future needs of the Empire for airlines are outlined as a means for overcoming postwar depression and for binding together the far-flung parts of the British Commonwealth. *Bulletins from Britain*, March 4, 1942.

**R.A.F. Flights Slowed by "Worst" Winter.** How the weather during the winter of 1941–1942 aided the enemy and retarded the efforts of the R.A.F. are revealed in a description of the operations of the Meteorological Service. With one exception, the past winter was the worst in 15 years, keeping on the ground the large bomber forces that had been built up in the hope that the long winter nights would furnish an opportunity to repay the enemy for the raids on Britain. Despite the risks, flights were carried out, but disaster often followed, one particular night bringing the loss of 27 bombers, not by enemy action but by ice.

Measures taken by the Meteorological Service in forecasting weather conditions are detailed, with information on cloud conditions and blind flying. *Bulletins from Britain*, March 4, 1942.




# PRACTICAL DATA FOR PRESENT PROBLEMS

Here are two books designed to help users of Molybdenum steels and irons to conserve all alloying elements, and possibly steel and iron, by getting the most in the way of strength, toughness and wear resistance with the lowest alloy content.

**"MOLYBDENUM IN STEEL"** covers the fundamental metallurgy of Molybdenum steels. Heat treatment – physical properties – applications – of a number of these steels are treated at length.

**"MOLYBDENUM IN CAST IRON"** covers the effect of Molybdenum in gray iron, giving suggested analyses for practical applications and detailed discussion of high strength (60,000 p.s.i. and up) irons.

Both books will gladly be sent free on request.

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*Books reviewed in this section may be purchased, or borrowed without charge, from The Paul Kollsman Library, Institute of the Aeronautical Sciences, 1505 RCA Building West, Rockefeller Center, New York, N. Y.*

## Fluid Mechanics and Statistics

This book contains eight papers on the general subjects of fluid mechanics and the statistical methods in engineering, presented at the Bicentennial Conference of the University of Pennsylvania. While all of these are complete and separate papers, a continuous line of thought seems to flow through the entire presentation.

Dr. Hugh L. Dryden, Chief of the Mechanics and Sound Division of the National Bureau of Standards, presented the first chapter in a study of "The Role of Transition from Laminar to Turbulent Flow in Fluid Mechanics."

Prof. Theodore von Kármán, Director of the Daniel Guggenheim Aeronautical Laboratory of the California Institute of Technology, discussed the "Problems of Flow in Compressible Fluids," which included such general points as gas dynamics in hydraulics fashion, shock waves, the analogy between open channel flow and flow of elastic fluids, problems of subsonic flow in aeronautics, and the application of the theory of compressible fluids to exterior ballastics.

The Assistant Professor and Research Engineer of the Iowa Institute of Hydraulic Research, Anton A. Kalinske, presented "Investigations of Liquid Turbulence and Suspended Material Transportation," while Dr. Thomas K. Sherwood of the Massachusetts Institute of Technology presented an examination of the "Mass Transfer and Friction in Turbulent Flow."

The second section of the book, devoted to the statistical methods in engineering, is opened by a paper entitled "Contribution of Mathematical Statistics to Scientific Methodology" by Dr. Samuel S. Wilks, Associate Professor of Mathematics at Princeton University. This paper dealt generally with a methodology founded on the probability theory for making inferences and predictions from observations.

Dr. Walter A. Shewhart of the Bell Telephone Laboratories, in his paper entitled "Contribution of Statistics to the Science of Engineering," presents a survey of the potential contributions of statistics by indicating the difference between engineering with and without statistical aid. Along the same lines, Capt. Leslie E. Simon, of the U.S. Army, Executive Officer of the Ballastic Research Laboratory at Aberdeen Proving Ground, offered a paper on the "Contribution of Statistics to the Development and Use of Purchasing Specifications and Standards of Quality." "The Relation of Statistical Quality Standards to Law and Legislation" by Prof. Roscoe Pound, former Dean of the Faculty of Law, Harvard Univeristy, is the concluding paper in this book.

**Fluid Mechanics and Statistical Methods in Engineering;** University of Pennsylvania Press, Philadelphia, 1941; 146 pages, $1.75.

## Strength of Materials

Favoring the lecture method of procedure in either classroom or textbook, the author presents the material in this book in the same order and sequence that he used in presenting it to his classes in engineering mechanics at the University of Michigan. The graphic summation method was adopted as the most general and the one most easily applied. The book is not a handbook but has been written primarily for men with college training and several years of practical experience. One of its purposes is to eliminate the confusion of the student in the matter of terminology and in having the theory of elastic energy brought to him piecemeal, with one part coming to him from one author and other parts from other authors.

In connection with the elastic energy theory, the author advances two claims: first, that the theory of elastic energy may be developed inductively from the principles of conservation of energy equally as well as it may be developed deductively from Castigliano's partial differential equation; second, that the theory of elastic energy is a general one, that it is applicable to trusses, straight beams, bents, and curved beams alike.

Within the assumption of elastic behavior of material and the principle of superposition, the theory of elastic energy is held to be able to accomplish all that any other theory or method will do. In the author's opinion it is not only the most general theory available but it is also the simplest and easiest to grasp. The basic philosophy given in Chapter II along with the principle of conservation of energy underlies every argument and every analysis of the problems discussed in the text and listed in the back of the book.

The most important change in this second edition of the book is the revision of the notation, the author finding it worthwhile to simplify the original notation and bring it into closer agreement with notations found elsewhere. The notation and typographic conventions are placed at the beginning of the volume. Some new material has been added, notably on signs, symmetry and antisymmetry, piston rings, pipe problems, spiral springs, and columns.

**Elastic Energy Theory,** Second Edition, by J. A. Van den Broek; John Wiley and Sons, Inc., New York, 1942; 293 pages, $4.50.

## Bomb Proofing

One of the first methodical presentations of those measures which can and should be undertaken to make building construction resistant to the effects of bombing at reasonable cost. The two authors—professors at New York University—have prepared and compiled the material for national training courses under the auspices of the Federal Office of Civilian Defense and the United States Office of Education in cooperation with the engineering colleges of the country.

Discussion of the characteristics of bombs offers an introduction to the main subject. Review of design procedures, present construction practice and proposed modifications of construction follows. The book then goes on to evaluate shelter zones in existing buildings, air raid shelters and camouflages. A brief statement of other engineering problems related to aerial bombardment is also included.

**Aerial Bombardment Protection,** by Harold E. Wessman and William A. Rose; John Wiley & Sons, Inc., New York, 1942; 372 pages, $4.00.

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## Military Training

A comprehensive survey of all the various types of Army training. Since the modern Army is a product of complexity and specialization, no longer does the word "soldier" cover a given set of duties similar to that of every other soldier. This book reveals the training for the different kinds of military service—infantry, cavalry, air corps, field and coast artillery, the armored force, and the signal, engineering, quartermaster, ordnance, and medical corps. It follows the recruit from the time he joins the Army, through his training and camp days, on to maneuvers.

**He's in the Army Now,** by Capt. William H. Baumer, Jr.; Robert M. McBride & Company, New York, 1941; 254 pages, $2.50.

## Design Text

An introduction to the field of aeronautical engineering discussing the component parts of an airplane not only as to their functions but also as to their effects on the aeronautical engineer's primary problems—dependability, light weight, and aerodynamic refinement.

An attempt has been made to discuss the airplane's internal components more nearly in relation to their relative importance in airplane design than is usually done. Characteristic problems in design as encountered in airplane factories are pointed out and some typical solutions of these problems are offered.

The subjects covered are: types of aircraft and airplanes, external and internal airplane components, aircraft radio and instruments, airplane engines, and propellers.

**The Airplane and Its Components,** by W. R. Sears; John Wiley & Sons, Inc., New York, 1942; 75 pages, $1.25.

## Aircraft Primer

A primer of the materials, machines, tools, and the various processes used in the construction of airplanes. The purpose of the information presented is to assist in the application of mechanical aptitude to aeronautical occupations.

Advice on aircraft manufacturing as a career, vocational training, and getting a foothold in the industry serves as an introduction.

The book then goes on to explain the elements of the theory of flight, the principles of the aircraft engine, elements of blueprint reading, machine tools in aircraft, and the toolroom. Principles of sheet-metal work, bolting, riveting, welding, and the assembly shop are also described. Some counsel on "getting ahead" is given as a conclusion.

**The Aircraft Apprentice,** by Leslie MacGregor; Pitman Publishing Corporation, New York, 1942; 131 pages, $1.50.

## Navigation and Avigation

The five major problems of navigation covered by this illustrated text are: (1) dead reckoning, (2) latitude determination, (3) longitude determination, (4) compass error determination, (5) identification of an unknown star. All the celestial navigation is worked by the short method of H.O. No. 208 Dreisonstok, and sections are devoted to problems and answers in piloting and chart navigation for aviators.

Part I describes how to navigate a ship without the use of sextant. Part II tells how to navigate a ship by means of sextant observations of heavenly bodies. Part III contains the Rules of the Road, indexed tables including Dreisonstok's tables, reports, data, and problems.

**Navigation for Mariners and Aviators,** by Capt. David Polowe; Cornell Maritime Press, New York, 1942; 516 pages, $5.00.

## History of the R.A.F.

This first of a contemplated series of volumes on the history of the Royal Air Force covers the period from 1919 to 1940.

As an aftermath of the first World War, Britain dropped from a first-rate to a third-rate air power because, it was said, politicians were trying the expediency of disarmament in the interests of peace. This book relates how the Air Council took the first opportunity to rebuild and expand the Air Force and tells of the leadership and organization that were necessary to make use of the latest scientific research and technical inventions, the superior types of aircraft that were developed, and the shadow-factory system that laid the foundations for rapid expansion in case of war. It tells about the creation of the Bomber, Flight, and Coastal commands, as well as the R.A.F. Volunteer Reserve, and the decision to discontinue the Air Force Displays at Hendon in favor of operational training.

There is an account of the Royal Air Force in France—those in command, the situation of the aerodromes, the difficulties of operational work, the restrictions on bombing, how civil air pilots and airplanes did transport duties in support of the first squadrons in France—and of the first battles between the Air Force fighters and the Messerschmitts and Dorniers.

The last section, covering the campaign in Norway, describes how, by making use of frozen lakes and moraines for ground bases, the Royal Air Force opened the offensive but met for the first time superior air power because the German High Command had put ten times as many aircraft into their operations as the best numbers the Royal Air Force could muster.

**The Royal Air Force in the World War,** by Capt. Norman MacMillan; George G. Harrap & Co. Ltd., London, 1942; 239 pages, 10*s.* 6*d.*

## Wood

An engineer's study of the structure, properties, and uses of wood, discussing its processes and applications in modern civilization.

This book, written by the senior wood physicist of the U.S. Forest Products Laboratory, introduces the subject by explaining the nature of wood itself and graphically presenting the life of the tree and its relation to the human race. Aided by photomicrographs and sectional drawings, the structure of wood itself and methods of identifying it are presented. Other significant material provided covers the mechanical, physi-

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cal, and chemical properties of wood; its handling in modern commerce; and special applications of general timber study to the woods native to the United States.

The latter part of the book is devoted to the engineering phases of wood as a structural material. Such necessary data as density, absorption of liquids, the effect of various periods of differing temperature and humidity and the biologic destructive agencies and preservation agencies applicable to wood structures are explained. An identification key for American woods and numerous other tables including the linear shrinkage at room temperatures, chordage conversion factors, comparisons of board feet with log feet, etc., are presented.

**Wood Technology,** by Harry Donald Tiemann; Pitman Publishing Corporation, New York, 1942; 316 pages, $3.50.

## Canadian Pilot's Manual

A Canadian adaptation of the Ground School Syllabus of the British Commonwealth Air Training Plan, this text is based on the theory that one learns to fly *in the air*, and that more important than merely piloting the airplane are accurate avigation, good weather sense and a thorough knowledge of the uses, function and limitations of the airplane.

While the material on general airmanship, theory of flight avigation, etc., is similar in content to most works on the subject, the entire presentation is kept on a businesslike, instructor-student level. The treatment presumes on the part of the student a standard of intelligence equal to requirements of the Royal Canadian Air Force, and enough previous interest to have acquired at least a few elements of physics and aerodynamics. The special R.C.A.F. ground and semaphore signals, typical of Canadian operation, are particularly interesting.

**From the Ground Up,** by Sandy A. F. MacDonald; Aviation Service Corporation, Ltd., Toronto, 1941; 68 pages, $1.00.

## Standard and Exploration Mapping

A text on aerial photographs, standard laboratory practice and the various methods of utilizing aerial photographs for making standard and exploratory maps, mosaics, and engineering surveys. Wherever possible mathematically proved practices are followed but practicality is not sacrificed for mathematical analyses.

Based on lectures given at the Institute of Geographical Exploration of Harvard University, this is a systematic study of aerophotography and aerosurveying. It is intended as a start for the student whose interest may be centered in the particular field of air work, that of extreme refinement and precision in making maps of important areas under special investigation, or the one who will require the more general use of aerial photographs in making exploratory and reconnaissance maps of large areas.

**Aerophotography and Aerosurveying,** by James W. Bagley; McGraw-Hill Book Company, Inc., New York, 1941; 324 pages, $3.50.

# Library Accessions

**Transatlantic Pilot,** by Frederic Nelson Litten; Dodd, Mead & Company, New York, 1940; 307 pages.

A tale of adventure based on the air conquest of the oceans.

**Our Airliners,** by Irving Crump and Norman Maul; Dodd, Mead & Company, New York, 1940; 249 pages.

A boy's history of the development of the U.S. airlines from the post-war era to the present.

**Instrument Flying Instruction Book,** by Howard C. Stark; James Stark, Pawling, N. Y., 1934; 77 pages.

A pilot's handbook on instrument flying which explains the function and application of the various instruments to the problems of blind flying. A practical course in instrument avigation is also offered.

**Battling the Elements,** by Bob Buck and Bob Nixon; G. P. Putnam's Sons, New York, 1934; 192 pages.

The adventures of two boys and a Monocoupe on a flight into Mexico.

**The Airplane Engine Mechanic;** U.S. Government Printing Office, 1931; 247 pages.

The official U.S. Army Air Corps mechanic's textbook, which explains the principles of internal combustion engines, general information on their operation and specific maintenance instructions on the Liberty, D-12 and Wright J5 engines.

**Wings Over the Americas,** by Alice Rogers Hager; The Macmillan Company, New York, 1940; 162 pages.

An account of an air tour through Central and South America, giving glimpses into the economic and social life of neighboring nations and explaining the operation technique of the Latin American airways systems.


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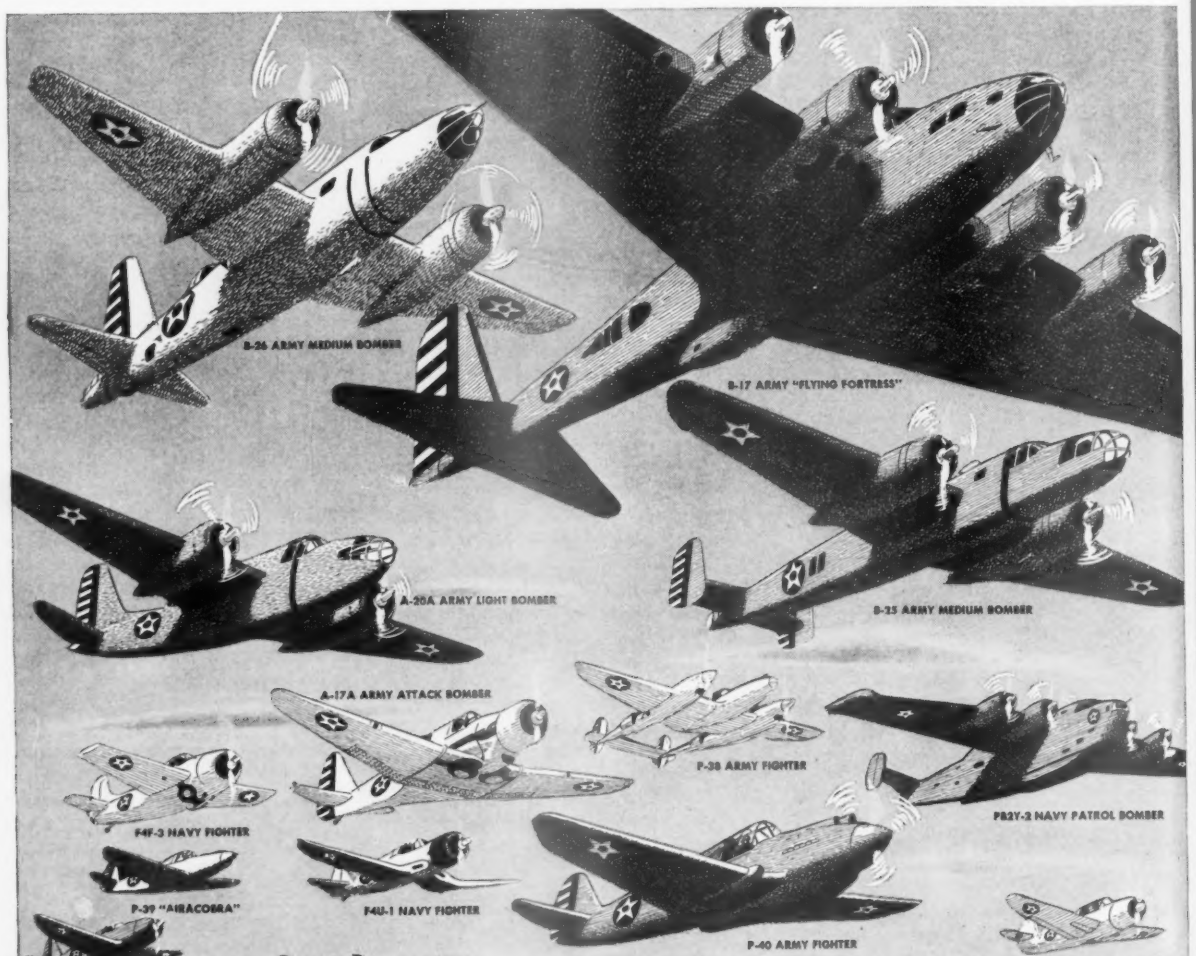

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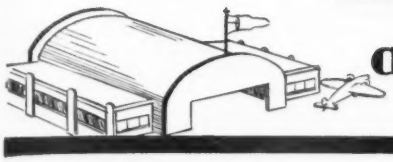
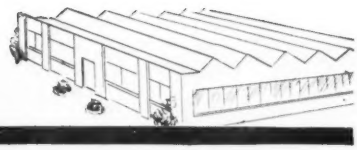




### Civil Flight Training in Wartime

*Civil Pilot Training and National Defense.* Bert A. Shields. A narrative of the C.A.A. Civil Pilot Training Program's part in the national emergency, giving concise and current information on the courses offered. Although initiated in peacetime as a civilian project, the Civil Pilot Training program has been incorporated into the war effort both as a defense measure and as preparation for military training.

Carrying the student from the initial stages of flight training to a commercial pilot certificate with an instructor rating, the Civil Pilot Training Program consists of four separate courses: primary, secondary, cross country, and instructor. Besides training thousands of students for positions with airlines and as instructors in the Program, completion of these courses has prepared a large group for active combat service with the Army and Navy. With the addition of an instrument flying course, for which plans are now being formulated, the complete C.A.A. curriculum should qualify graduates for all types of commercial and auxiliary military flying. *Technical Education News*, February.

### Inspection Tools

A new folder describing the *Magni-Ray* and illuminated magnifier developed for the close inspection of airplane parts has been issued by the George Sherr Co. of New York. The instrument consists of a recessed bracket and achromatic lens into which two frosted light bulbs have been incorporated. These are attached to an upright stand so fixed that height and angle of the lens-illuminator may be varied by height according to the requirements of the job. The entire head also may be removed for portable inspection.

### Peruvian Development

*Aircraft Construction in Peru.* A brief history of Faucett Airlines of Peru (Compania de Aviacion "Faucett" S.A.), which began with charter flights in Peru using Curtiss Orioles in 1920, developing into one of the most successful independent operations in Latin America. Special types of aircraft were needed to suit the particular terrain and operational conditions and, since 1928, Faucett has developed many types for its own use. The latest of these, an eight passenger high-wing braced monoplane, powered by a 600 h.p. Pratt & Whitney Wasp engine, is also described. *The Intavia World*, December.

### Planetary Milling

*"Just Push the Button."* A 6-page folder describing the principles and applications of Pan-O-Mill, manufactured by the *Gordon-R Company.* Actual pictures of the machine, methods of operation, and specifications simplify the explanation of how this recent development can expedite thread-milling and many types of form-milling operations. Differing from the conventional type milling machine in that all motion is in the cutting head, the prime feature is that the work itself is fixed. *Gordon-R Company.*

### Company History

*North American Story.* The history of North American Aviation, Inc., began with the Fokker Aircraft plant in the early twenties. This pioneering company, along with the Pittsburgh Metal Airplane Company, Berliner-Joyce, the American Airplane and Engine Corporation and others, was acquired to form the General Aviation Corporation, which later became North American.

The influence of J. H. "Dutch" Kindelberger on the progress of the company, and on the varied types that have been produced since the first order for 84 NA-16 trainers was filled, is related. *North American Skyline*, January.

### Pioneer Biography

*Barling, the Bomber Pioneer.* Richard David. A brief biography of the aviation career of Walter H. Barling and the harbinger bomber he designed.

Commissioned by Brig. Gen. William Mitchell after the last war to design a large bomber whose parts would have to be fabricated in New Jersey but assembled in Ohio, Barling had to create an airplane that not only would fly but would fit into a wind tunnel as well. The experiment was successful but the time had not yet come for government adoption of bomber production. Today, Barling is working on big bombers as an engineer with Consolidated. *Consolidator*, March, 1942, page 16, 2 illus.

### Forced Convection Heating

What is claimed to be a new application of a heating principle, completely invalidating old theories, is embodied in the Lindberg Super-Cyclone furnace, making available 100 per cent forced convection heating up to 1,750°F. for such operations as hardening, annealing, normalizing, and others. A leaflet states that the furnace will permit a rapid increase in heat-treating production in a limited floor area, prevent distortion in heating or quenching, and reduce heating and handling costs. *Lindberg Engineering Company.*

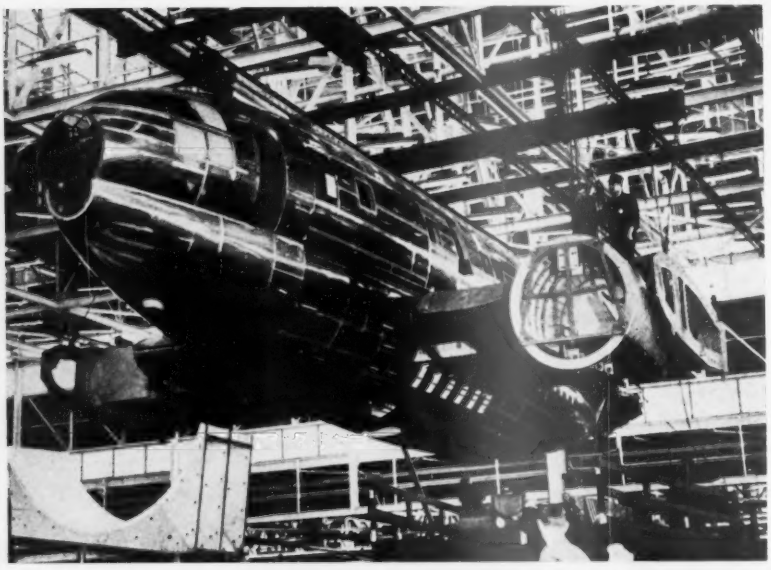
### Light Airplane Brochure

The O-58 series of observation airplanes, built for the U.S. Army, is identical in construction with its civil version, the Aeronca "Defender" trainer. An illustrated brochure describes the components, characteristics, and performance of the Defender and its suitability for commercial and civil use.

Among the improvements listed are: a new type muffler, engine cowling modified and strengthened around the base to reduce engine noise in the cabin, new window design, redesigned door to permit easier access to the cabin, reduction of control system operating loads, and rearrangement of the instrument panel for greater convenience for both occupants. Specifications are included. *Aeronca Aircraft Corporation.*

### Industrial Equipment

*This Modern Plant Available for Defense Work.* Offering the company's services to prime war production contractors, this is a brochure on the fabricating, assembly, and testing facilities of the Bastian-Blessing Company's Chicago plant.



Moving the assembled fuselage and center-section of a Curtiss C-46 twin-engined military transport from the splicing frame to the final assembly department on an overhead conveyor system.

Illustrations of typical standard products and war production items represents the type of work the firm is in a position to handle on a production basis. The facilities of the plant lend themselves particularly to the assembling and testing of small items such as valves, special pressure regulators, and other products. A list of the machine tools with which the plant is equipped is included. *The Bastian-Blessing Company.*

### Cold Chamber

*Laboratory.* For high-altitude research the Boeing "cold room" enables engineers to emulate the low temperatures of the stratosphere, combines low temperatures with low pressures, and provides the vibrations to equipment which would occur in actual flight.

This article describes the mechanical refrigerating unit that operates the polar laboratory and the construction of the laboratory itself. The conditions simulated by this "test room" and the results achieved with it are also related. *Boeing News*, February, 1942, pages 3–5, 8 illus.

### Glass Insulation

*Fiberglas at War.* Employed primarily for electrical and thermal insulation in production, operation, and maintenance, this "double spread" illustrates the uses of Fiberglas in homes, in industry and, most important, as an aid to war mechanization. *Owens-Corning Fiberglas Corporation.*

### Plywood Bonding

*Plywood Bonding with Resin Adhesives.* This manual of recommendations for the effective use of resin adhesives in hot-pressing and cold-bonding processes includes an appendix of information and tables for plywood manufacturers.

Principles of hot-press technique are explained and illustrated, as are hot-press bonding with Tego, Amberlite and Uformite, and the properties of Amberlite PR-14 and PR-28. Cold bonding with Uformite is also described in detail *The Resinous Products & Chemical Company.*

### Aircraft Hardware

A catalogue offering descriptions, specifications, and plan-view drawings of standard aircraft hardware, including hexagon, drilled head, and clevis bolts, clevis pins, fillister and washer head screws, threaded taper pins, and other types of A-N aircraft hardware. *Aero Screw Company.*

### 'Cobra Cables

*Cable Splicing.* Eight illustrations graphically depict the consecutive steps in a cable splicing operation for the Airacobra, from the insertion of the cable into splicing jaws until the complete splice is obtained. *The Bellringer*, March, 1942, page 11, 8 illus.

### Plastic Transparencies

*For Visibility Unlimited.* Neil Ames. In its application to aircraft, Plexiglas is utilized for those parts of the airplane where visibility is necessary. In addition to its use around the pilot's enclosure and gun turrets of all models, its most spectacular application at Consolidated Aircraft has been around the turrets of the PBY's. Its finished appearance in this capacity has produced the nickname of "blisters."

This is a report on Consolidated's blister department, its methods of operation, and the production and maintenance of its Plexiglas formations. Also described is the method of repairing Plexiglas breaks by means of a liquid cement strong enough to withstand the heavy stresses to which an airplane is subjected yet light and fluid enough to be applied with a hypodermic needle. *Consolidator*, March, 1942, pages 17, 25, 4 illus.

### History and Progress

*Our Part in the War Effort.* Preceded by a statement of the principles of the corporation, this pamphlet offers a résumé of United Aircraft's history from its inception to its present-day role in the war program. It covers the expansion of the three manufacturing divisions—Pratt & Whitney Aircraft, making air-cooled radial engines; Hamilton Standard Propellers, making metal propellers; Vought-Sikorsky Aircraft, making airplanes—and their apposition with military preparation.

The association of engine, propeller, and airplane manufacture in one corporation was the result of a conviction that their development is interdependent. This integration produced such technical contributions as the air-cooled radial engine and the controllable-pitch propeller which laid the foundations for an economically practicable large airplane.

As a conclusion, the leaflet details a statement of approximate earnings and the consequent adoption of a voluntary profit control by United Aircraft. *United Aircraft Corporation.*

### Aircraft Fasteners

A four-page folder gives the specification and construction details of three types of clips for aircraft fastening. Diagrams show how the fasteners operate.

Particularly adaptable to internal panels requiring frequent removal are the Type "P" and "R" Fasteners, operatable entirely by the fingers and eliminating the need for tools. They are designed to yield a minimum amount of drag when used in the airstream.

Type "T" Clip is a cowling fastener for heavy duty. It does not depend on a rivet for attachment or on a spring to maintain its grip. Although it can be opened or closed without the use of tools, it is based upon a principle involving no vibration of the cowling.

For lightly loaded inspection doors and similar installations there is the Type "F" Fastener, worked on the same principle as the "P" and "R" Types. A base plate contains a special spring whose parallel arms engage in grooves in a removable stud. To release the fastener, the stud is turned 90 deg. by means of a tool or coin. Snap replacement secures the panel. *Simmonds Aerocessories, Inc.*

### Automobiles to Airplanes

*Model Changes—War Style.* Based on an informal talk by O. E. Hunt, Engineer for the General Motors Corporation, at a meeting of the Automotive Council for War Production, this pamplet contains a pledge of dedication by the automobile industry for conversion to war production.

In summation five points are made: (1) Facilities in plants, man power, and personnel must continue to be loaded to the very limit of their ability just as fast as war work is assigned to them; (2) every ingenuity must be exerted to get the projects that are still in the make-ready stage into mass production at the earliest possible time; (3) the timesaving goal must be adhered to with the spirit and courage that accomplishes miracles; (4) every assistance must be rendered to the armed forces in speeding up the job of training millions of nontechnical recruits in the proper use, care, and repair of the highly technical mechanized equipment that they are being called on to build; (5) to those ends intelligent and unreserved cooperation are supremely necessary. *General Motors Corporation.*

### Airport Lighting

*Airport Lighting and Distribution Equipment.* Recommendations and layout assistance accompany a list of required apparatus for airport lighting projects. This loose-leaf handbook contains selection data, including typical specifications covering lighting and distribution equipment approved by the Civil Aeronautics Administration.

One section of the booklet disseminates information on a C.A.A. Typical Airport Lighting Layout Plan; another, on C.A.A. Recommended Standards for Airport Lighting. Airport Lighting Distribution Equipment and Airport Lighting Equipment furnish the third and fourth sections. Appended are prints of typical wiring layouts for each airport classification and a typical lighting layout, keyed by symbols. *Westinghouse Electric & Manufacturing Company.*

### Conduit Clamps

Announcement is made of a complete line of 735 type conduit clamps, with or without speed nuts. Sizes range from $^1/_{16}$ to 2 in. outside diameter of tubing or rigid conduit. *Timmerman Products, Inc.*

### Working for Victory

With pictures and explanatory paragraphs, the activities of one of the leading makers of precision machines and tools are related, emphasizing the practically complete devotion of the organization to war work. As early as 1935, the company was engaged in developing a shell-turning lathe and later a horizontal-type rifling machine for government arsenals. Among other products shown as contributing to the war effort are Diesel fuel injection equipment, precision boring, grinding and cutting machines, and aircraft parts, for which a whole division has been established. Other departments illustrated are railroad equipment, food machinery, research and experimental, training, and plant protection. *Ex-Cell-O Corporation.*

### Transformers

Presenting a full line of U.T.C. transformers for broadcast, amateur, laboratory, and replacement purposes, this new catalogue is said to include 5,000 new designs. Information is given on the individual characteristics of each line and the application of these devices to the specific service for which each is intended. *United Transformer Company.*

### Starters and Generators

Electric starters for light airplanes capable of starting engines up to 175 and 300 hp. and operating on 6 or 12 v. are briefly described and illustrated, as well as engine-driven and air-driven generators and accessories. *Champion Aviation Products Company.*

### Welding

*Resistance Welding for the Arsenal of Democracy.* New types of machines for spot welding of aluminum and aluminum alloys are described and illustrated, with their capacitor discharge stored energy control panels, as well as a gigantic hydraulic machine designed for the production of carboloy. The latter exerts a maximum pressure of 200,000 lbs. but can be adjusted to as low as 6,000 lbs. A heavy duty mill-type flash welder is also shown as used in manufacturing aircraft valves. *National Electric Welding Machines Company.*

### Small Bearings

*Radial, Pivot, and Special Bearings in Miniature Precision Sizes.* A new catalogue, No. 41, issued by Miniature Precision Bearings supersedes all previous information on their radial, pivot, and special bearings in miniature precision sizes. It includes technical data, specifications, applications, and descriptions of their various products. *Miniature Precision Bearings.*

### Mechanical Oscillator

Bulletin No. 156, of The Baldwin Locomotive Works, Baldwin Southwark Division, sets forth the principles of The Bernhard Mechanical Oscillator, a dynamic testing machine. The dynamic method, using artificial vibrations produced by means of the mechanical oscillator, enables tests to be made on units varying in size from a small specimen to a full size structure, taking into consideration the stress in structural joints.

Specifically considered are test procedure, construction, and particular applications. According to the leaflet, this method is expedient for studies ranging from tests on springs to soil investigations. *The Baldwin Locomotive Works.*

### Electrical Devices

*Relays and Other Devices for Electrical Control.* A catalogue on relays and other devices for electrical control contains information on relays, switches, controls, and miscellaneous equipment.

Many kinds of relays are described for telephone, aircraft, and miscellaneous use, including polarized, Autelco, Jr., spring contact, mercury contact, and other types, as well as mountings for relays. Switches are the stepping, Minor, two-motion, eleven-point, 25-point, and 50-point rotary types. Under controls are described impulse senders, switchboard keys, lamps and holders, indicators and drops, jacks and plugs, cords, and accessories. The section on miscellaneous equipment covers handsets, solenoids, electric counters, spark suppression, power apparatus, etc. *Automatic Electric Company.*

### Measuring Instruments

Two sheets containing specifications and descriptive data furnish information on two gauges for precision measuring.

Model KP-96 is a portable thickness gauge for checking the wall thickness of 500 lb. demolition bombs. Model 45 B-80 incorporates a method of pitch diameter inspection which, it is stated, obtains results equal to those of the three-wire method of measuring used in checking the accuracy of threaded plug gauges and other precision screw threads. *Federal Products Corporation.*

### Rubber Conservation

To assist in the national program of rubber conservation made necessary by war developments, a series of pamphlets has been prepared on how to obtain the maximum service from industrial rubber products. The first four of the contemplated series of six deal with belting: No. 1, "Transmission Belting"; No. 2, "Conveyor Belting"; No. 3, "V-Belt Drives"; and No. 4, "Belt Salvage."

Each of the subjects is subdivided into chapters dealing with the various angles of the topic. Written in nontechnical language, they are comprehensive discussions of the best methods of maintenance and conservation of rubber. *The B. F. Goodrich Company.*

# These Metals Gain Strength at

# SUB-ZERO TEMPERATURES

## ...yet do not become Brittle!

**MECHANICAL PROPERTIES AT LOW TEMPERATURES**

| MATERIAL | Condition | Temperature °F. | Yield Strength (0.20% offset) psi. | Tensile Strength psi. | Elongation in 2 in. per cent | Reduction of Area per cent | Hardness Rockwell C | Charpy Impact Strength ft.-lb. |
|---|---|---|---|---|---|---|---|---|
| **MONEL** | Cold-drawn | Room | 93,700 | 103,800 | 19.0 | 71.0 | 19 | 181 |
| | Cold-drawn | −110 | 100,850 | 117,450 | 21.8 | 70.2 | 25 | 178 |
| **"K" MONEL** | Cold-drawn age-hardened | Room | 125,900 | 157,300 | 15.5 | 37.4 | 33 | 27 |
| | Cold-drawn age-hardened | −110 | 134,600 | 171,550 | 17.3 | 41.1 | 36 | 27 |
| **INCONEL** | Annealed | Room | 36,800 | 93,800 | 37.3 | 64.1 | 82B | 130 |
| | Annealed | −110 | 42,400 | 106,450 | 39.8 | 64.0 | 87B | 134 |
| | Cold-drawn† | Room | 147,700 | 152,100 | 7.0 | 49.3 | 31 | 54 |
| | Cold-drawn† | −110 | 154,900 | 163,900 | 9.8 | 51.2 | 36 | 60 |
| **NICKEL** | Cold-drawn | Room | 97,400 | 103,400 | 16.3 | 66.9 | 19 | 204 |
| | Cold-drawn | −110 | 101,800 | 112,300 | 21.5 | 60.9 | 22 | 215 |

† 50 per cent reduction in cross-sectional area by cold drawing.

*plus* **CORROSION RESISTANCE** . . . together with strength, hardness, toughness —

*plus* **EXTRA HARDNESS** . . . comparable to heat-treated alloy steel; age hardenable, non-magnetic —

*plus* **HEAT RESISTANCE** . . . with retention of high degree of strength. Resists oxidation, high corrosion resistance—

*plus* **NON-CONTAMINATION** . . . protects product purity; offers good electrical conductivity —

*plus* **MACHINABILITY** *and* **EXTRA HARDNESS** . . . free cutting, age hardenable, non-magnetic —

*plus* **RESILIENCE** . . . age hardenable, for exceptional spring properties, magnetic, good electrical conductivity —

*plus* **MACHINABILITY** . . . for high speed production in automatic screw machines —

*plus* **HARDNESS** *in* **CASTINGS** . . . anti-seizing and non-galling—

**"KR" MONEL**

**"Z" NICKEL**

**"R" MONEL**

**"S" MONEL**

Selecting the right metal for a given application is today more important than ever. How drastically the possibilities narrow down is exemplified by *sub-zero* requirements.

At sub-zero temperatures, for example, most ferrous metals become brittle as their strength increases. INCO Nickel Alloys also increase in strength and hardness . . . but they retain room-temperature ductility and toughness as measured by tensile and impact tests (*see table above*).

Two INCO Nickel Alloys, "K" Monel and "KR" Monel retain another important property, non-magnetism . . . magnetic transformation point of these age-hardened alloys being −150° F.

A new technical insert, "Mechanical Properties at Low Temperatures" and the booklet "Individualized INCO Nickel Alloys" offer useful information. For copies of each write to:

**THE INTERNATIONAL NICKEL COMPANY, INC., 67 WALL ST., NEW YORK, N.Y.**

### FIRST THINGS FIRST

*With the Nation at war, supplies of Monel, Nickel and Nickel Alloys are needed for our armed forces. All efforts must now be aimed toward victory. In the meantime The International Nickel Company will continue to issue information which it is believed will be of interest to metal users who are concerned with the war needs of today and the peace-time progress of the future.*

★ ★ ★ ★ **INCO NICKEL ALLOYS** ★ ★ ★ ★

**MONEL • "K" MONEL • "S" MONEL • "R" MONEL • "KR" MONEL • INCONEL • NICKEL • "Z" NICKEL**

***Sheet . . . Strip . . . Rod . . . Tubing . . . Wire . . . Castings***

# From the Industry

*Releases are printed as received from companies and other aeronautical organizations and the responsibility for the accuracy of all statements is therefore not assumed by the Aeronautical Engineering Review.*

## Ahrens Controls, Inc.

For that problem of remote control where the point of control is disadvantageously situated with reference to the point of application, the flexible unit is the most desirable solution. But the question always arises as to what type of unit is necessary. The application sometimes requires a lock, sometimes just a straight "push-pull," or perhaps vernier adjustment. Which one to choose is often a problem, especially where it is necessary to obtain control with all these characteristics.

The particularly difficult combination to obtain is that of the vernier and the lock. The locking action is usually accomplished with a friction device and requires release of a button or in most cases the engagement of a knurled nut. However, there is a new development involving a positive lock, not merely friction action, where the lock and the vernier are engaged at all times. When coarse adjustment is required, a slight pressure of the hand releases the thread engagement, which serves the dual purpose of providing the positive lock and the worm thread for fine adjustment. Essentially, the control is designed for those installations where the vernier adjustment and the lock are primary considerations and push-pull movement is of secondary importance. Actually, however, it provides all three and is unique in this respect.

The small pin set in at the top of the face plate rides in the groove of the worm thread when the pressure exerted by a spring in the bottom of the face forces the plunger or movable threaded rod into engagement. This engagement is released when the pressure of the hand on top of the knob depresses the spring and allows the plunger to move freely. Immediately upon release of the hand pressure, the spring forces reengagement and the positively locked condition.

This head can be mounted on any type control, with a sliding flexible member of piano wire or wound spring designed to take a tension load.

## American Silver Producers

"It appears likely that an important use of silver will result from the application of the ultra-light magnesium alloys in the aviation field. Because of the high physical properties attainable in silver-rich magnesium alloys, it seems that some application may eventually be made in alloys of this type also." So reads a portion of a recent report issued by The American Silver Producers' Research Project. This seems to be borne out by data on a magnesium alloy containing 2.6 per cent each of aluminum and zinc, 5.5 per cent silver and 0.2 per cent manganese and which has a specific gravity of only 1.89. This alloy, in extruded bars, rolled sections, and large forgings is reported to give the following physical properties after suitable heat-treatment: tensile strength, 40,000 to 65,000 lbs. per sq.in.; yield strength, 32,000 to 50,000 lbs. per sq.in.; elongation, 2 to 10 per cent; Brinell hardness, 80 to 95. This alloy has a corrosion resistance comparable to all except the most corrosion resistant of commercial magnesium alloys.

Research has not yet gone far enough to make further predictions as to the future of alloys of magnesium containing silver, but the properties attained seem to indicate possibilities that the producers of magnesium and silver are not likely to overlook and which the users of light alloys will be likely to investigate further.

## Boots Aircraft Nut Corporation

To help speed production and save time, the Boots Aircraft Nut Corporation announced that machine-dimpled rivet holes are now available on its entire self-locking anchor nut line. Many companies want flush rivet mountings, and this extra service will help aircraft factories eliminate the time-wasting need of machine countersinking in their own shop.

This augments the present line of plain base rivet holes by the addition of dimpled rivet holes for use with 78-deg. and 100-deg. countersunk rivets. Parts with rivet holes so specified are identified by adding suffixes to the standard part number.

## Curtiss-Wright Corporation

The first of a large production order of Curtiss Condor III or C-46 airliners, the world's largest twin-engined transport type, is now taking form in one of the mammoth American plants of Curtiss-Wright Corporation's Airplane Division, for delivery to the U.S. Army Air Forces. Its production is ahead of schedule according to Burdette S. Wright, Vice-President and General Manager in charge of that organization's aircraft manufacturing.

Based upon the design of the Curtiss CW-20 airliner accommodating 36 passengers, a crew of five, and a large mail and express cargo, the new Condor III type will transport "many more than 36 fully equipped infantrymen," light field artillery, or one or more light reconnaissance cars to critical points in a battle zone at high speeds approaching that of two-engined bombers. It has a wing span of 108 ft. and is powered with two 1,750 hp. engines.

Designed to be produced rapidly, the new military transport can be broken down into 54 major assemblies, permitting not only line production but also subcontracting of parts and assemblies. In addition, it is completely lofted with fully coordinated templates, thus assuring a high degree of interchangeability of parts approaching that of a high-production Curtiss pursuit type. Virtually every part except its highly streamlined fuselage is replaceable.

The new transport will withstand rugged service and can be quickly repaired in the field even though it may incur major structural damage. Thus, its engines may be replaced in a few hours by a crew of six; its wing panels may be replaced in four hours by a crew of eight without special equipment; a wing tip may be substituted in a matter of minutes; the landing gear assembly may be replaced in a few hours by a competent crew.

Much of the construction of the C-46 as a military transport may be traced to the original commercial design which

# Convoy of Commerce

Off shore... above coastal sea lanes... among islands... Lockheed Hudson bombers fly guard over ships that carry men and supplies to all our fighting fronts.

These vigilant sentinels are heirs of the first Lockheed Hudson—first American ship to serve with Britain's Coastal Command. In structure, they are the same tough transport design that needed few changes to become a famous bomber.

In armament, they are superior... re-armed and turreted to take full advantage of the lessons of total war.

In tradition of performance, they live up to the reputation of the Hudsons that helped perform the miracle of Dunkerque ...smashing hard, smashing often, to crush our Axis foes.

**... for Protection today and Progress tomorrow**

LOOK TO *Lockheed* FOR LEADERSHIP

*Hudson Reconnaissance Bomber • Lockheed Aircraft Corporation • Burbank, California*

Curtiss-Wright engineers developed with the cooperation and research aid of the major airlines. This design incorporated numerous aircraft advances including a pressurized cabin suited for substratosphere operation, thus anticipating a current trend toward high-altitude service by the airlines.

## Fisher Body Co.

As result of long experience gained in shipment of automobile body parts, Fisher Body has developed a new method to insure safe transport of bomber sections.

For use in shipment of automobile body parts such as roofs, door panels, floors, etc., Fisher Body had devised in recent years steel frame containers which materially lessened the danger of damage in transit. These containers now have been converted by Fisher Body for shipment of aircraft sections from fabricating plants to final assembly.

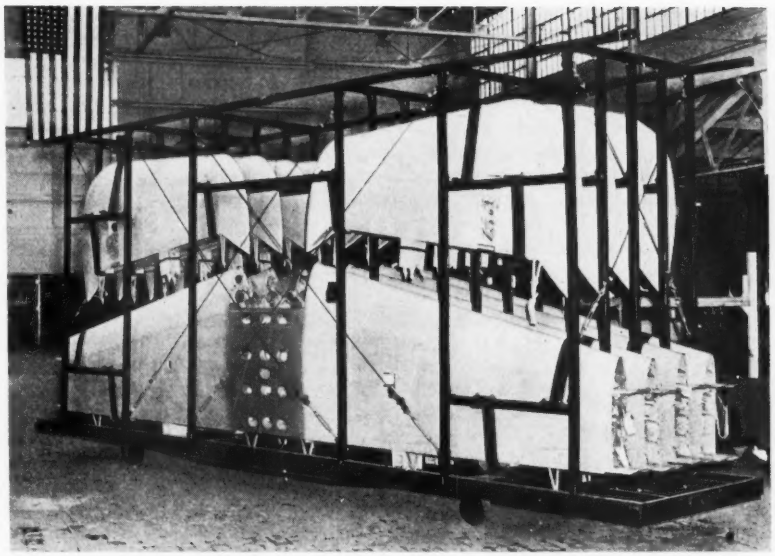
Plane part transportation formerly was handled by means of wooden crates built around the sections to be shipped. In shipment of sections built on a mass production basis such as Fisher Body now has undertaken, however, it was found that wooden crates would require excessive frame construction work, heavy charges because of the greater weight, and the complete loss of the wooden material at the destination, since it would be impractical to return the crates for repacking.

Shipments by wooden crates required from 2 to 3 lbs. of dunnage for each pound of goods. The new steel containers have lowered that ratio to about 1.5 lbs. of dunnage to 1 lb. of goods.

Furthermore, he said, since the steel containers are used over and over there is no loss of dunnage after each shipment. On this basis it has been figured that for shipment of all bomber parts called for in the existing Fisher Body contract, only 1 oz. of steel will have been used as dunnage for each pound of aircraft part shipped. The conservation of materials in the 1 oz. to 1 lb. ratio is obvious.

Within the Fisher plant where bomber parts are built the containers are loaded with wings, rudders, stabilizers, ailerons, or whatever parts are to be shipped. Each part is held in place with strong but elastic straps which tend to absorb any impacts incurred during transport. The containers are equipped with a type of rubber-mounted "knee-action" casters to lessen the danger to their valuable cargo while being rolled in or out of cars.

One important feature of the containers is the method of fastening them securely within freight cars. Several containers are shipped in each car, depending on their length, and cars used for this purpose are equipped with special brackets. These firmly grasp the containers at each end, while a horizontal jack between the containers keeps them securely locked within the brackets. This device gives strong protection against either forward and backward or up and down motion, while trucks in which the containers' casters are locked prevent sidewise sway.



Special steel rack containers used by the Fisher Body Co. to transport bomber subassemblies to the final assembly line. Each unit is held in the rack by an elastic cushion to prevent damage in shipment to the surface or structure.

## Fleetwings, Inc.

Latest addition to the large line of hydraulic equipment manufactured by Fleetwings, Inc., aircraft and aircraft parts makers, is a new valve, Model B2J, which provides a means of operating a gun turret at a variable speed in order to enable the gunner to maintain a continued fire on a moving target.

The valve is both light in weight and easy to operate. Only one valve is required per turret, as it incorporates two units—one for the lateral movement of the gun and the other for elevation control. The combined weight of the units, however, including operating mechanism, less grips, is under 5 lbs.

The B2J valve will operate without seizure from below minus 40°F. to above 200°F., and being fully balanced it requires a minimum force, 3 to 4 lbs., to operate over and above the force used in overcoming the centering spring. Particular care has been taken in the design so as to assure easy disassembly and assembly without damage to packing rings or other parts.

## General Electric Company

A new contactor specially designed to start and stop dynamotors used with aircraft equipment has been announced by the Industrial Control Division of the General Electric Company. It is available for either 12- or 24-v. direct-current circuits and conforms to the general requirements set up for aircraft control devices. The contactor is also applicable to tank installations.

The dynamotor contactor is approximately $2^1/_2$ in. wide and 4 in. high, weighs only 2.3 lbs., and can be mounted in any position. It is totally enclosed, with the contacts in the upper compartment and the coil and plunger in the lower compartment. Copper-lead-alloy contact tips are used to assure the best high-current inrush performance.

The contactor meets Signal Corps vibration requirements, being good for mechanical frequencies o˙ 5 to 55 cycles per second at a maximum of $^1/_{32}$-in. amplitude ($^1/_{16}$-in. total travel) applied in any direction. The single-pole, normally open contacts are designed to stay open when the coil is not energized and closed with the coil is energized, even when the contactor is subjected to a linear acceleration of ten times gravity applied in any direction or to the vibration conditions outlined above.

All ferrous parts of the contactor are treated to resist corrosion. Nonferrous parts are likewise treated except where such treatment would interfere with operation. The contactor is suitable for use in ambient temperature ranging from +60° to −40°C.

The contact rating is 50 amp. on an 8-hr. basis. Inrush current rating is 500 amp. at 32 v. direct current. Coil wattage is 9.5.

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A sturdy, lightweight relay, designed particularly for aircraft applications and

# KOLLSMAN

## AIRCRAFT INSTRUMENT INSTRUCTION MATERIAL

DESCRIBED on this page are the various types of informative material on instruments, made available by Kollsman to men engaged in aircraft work today. Each piece is designed for men in some particular phase of instrument operation, servicing, or maintenance.

If interested in getting more information about aircraft instruments read over the descriptions of the material and select that which meets your need.

FREE to anyone interested in aircraft instruments . . . the booklet "Facts About Kollsman Aircraft Instruments." In writing for other material give your industry connection as our supply is limited and we are trying to put it where it will do the most good.

HOW TO OBTAIN YOUR MATERIAL: Check the coupon and fill in your name and address and connection. Mail it to us at the coupon address.

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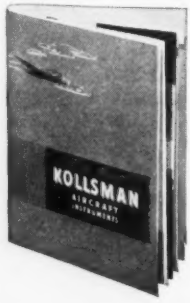
**TO ANYONE INTERESTED IN AIRCRAFT INSTRUMENTS**




**KIM 1 "Facts About Kollsman Aircraft Instruments"**

This 52-page book written in non-technical language and profusely illustrated is ideal for the pilot or student of aviation who wants complete general information about aircraft instruments—how they are made and tested, description of features and method of operation. Includes C.A.A. requirements for plane and pilot on instrument flying. (If ordering more than one copy, please state purpose for which they are to be used.)

### SENT WITHOUT CHARGE TO PURCHASING, MAINTENANCE AND INSTALLATION MEN, ENGINEERS AND DESIGNERS

**KIM 2 "Kollsman Catalog"**

Useful not only in purchasing instruments—the catalog also gives complete data on every instrument (weights, sizes, ranges, operating characteristics, etc.) required by engineers and designers. Information on commercial equivalents to Army and Navy instruments is included. Complete with price list. Looseleaf binder.

**KIM 3 "Spare Parts Catalog"**

This valuable catalog contains 140 pages of complete information on spare parts with parts prices for all of the standard types of Kollsman Instruments. Principal parts illustrated, giving correct parts numbers and quantities required for each instrument. Numerical parts list with prices makes it easy to order. Parts common to several instruments are easily identified by their identical parts numbers. This catalog, together with the Kollsman Catalog, forms a complete ordering reference.

### AVAILABLE TO GROUP INSTRUCTORS AND MAINTENANCE STATIONS FOR REFERENCE

**KIM 8 "Instructional Wall Charts"**

Size, 24" by 36". Cut-away sections show interior mechanism in detail with description of operation. Set of eight charts covers following instruments: Kollsman Sensitive Altimeter, Direction Indicator, Air Speed, Vertical Speed, Manifold Pressure Gauge, Centrifugal, Magnetic and Electric Tachometers. Particularly suited for instruction of groups in aviation schools and maintenance centers. Metal strips top and bottom keep charts flat and loop at top permits easy hanging. Sent without charge. (Not distributed to individual students.)

**KIM 4**

**THE POPU... "KOLLSMA... HANDBOO...**

**Now Widely U... Maintenance ... And In Class... of Aviation G... Everywhe...**

150-page leather covered looseleaf ... giving *detailed information on the cons... operation, testing and servicing procedure ...* teen commonly used flight and engine ... ments. Complete with charts and illustr... of instrument operation and step b... procedures. One chapter devoted to th... eral technique of instrument repair an... ing, in detail. Price, $2. Postage p... (25 copies or more, $1.75 each.)

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**Invaluable To Instrument Repair S...**

Up-to-date! Detailed! Sectional! Each s... covering complete field servicing instru... on a *particular type* of Kollsman Instrum... bound in expanding post binder. Illus... in detail. Each section deals with ope... principle, procedure for service inspe... testing and tolerances, cleaning and ... spare parts information and assembling ... Additional sections issued to registered ... ual owners as completed. Price, $10 p...

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**"Installation Instructions"**

Looseleaf binder, in sections, covering ... teen principal Kollsman Instruments—i... lation procedure, method of operation ... maintenance hints—with cut-away vie... the instrument operation, keyed to te... dimensional drawings. Intended pri... for installation men. Sent without c... Where detailed information on mainte... is desired, the Kollsman Handbo... recommended.

**KIM 7**

**"Test Specifications"**

116-page booklet giving detailed info... tion on *test procedure and allowable to...* (U. S. Standards) for the principal ... instruments—including requirem... for compass liquid, instrument lighting ... radio luminous material. Numerous c... Sent without charge.

Kollsman Instrument Division of Square D Company, 80-08—45th Avenue, Elmhurst, N.Y.
Gentlemen: Please send the following Kollsman Aircraft Instrument Instruction Material:

☐ **KIM 1** "Facts About Kollsman Aircraft Instruments" RE

☐ **KIM 2** ☐ **KIM 3** ☐ **KIM 4** $2.00 (25 or more $1.75 ea.) ☐ **KIM 5** $10.00 ☐ **KIM 6** ☐ **KIM 7** ☐ **KIM 8**

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KOLLSMAN
AIRCRAFT INSTRUMENTS
*Division of*
SQUARE D COMPANY
ELMHURST, NEW YORK • GLENDALE, CALIFORNIA
DETROIT, MICHIGAN

calling for operation at high altitudes under severe vibration conditions, has been announced by the Industrial Control Division of the General Electric Company. The relay is also applicable to tank installations.

Designated CR2791-A100A, the relay weighs only 4 1/2 oz., is 3 1/8 in. long, 1 5/8 in. high, and 1 3/8 in. wide and can be mounted in any position. It is designed for mechanical frequencies of 5 to 55 cycles per second at 1/32-in. maximum amplitude (1/16-in. total travel) in any direction. Altitudes from sea level to 40,000 ft. and ambient temperature ranging from −40° to +93 1/2°C. fall within the performance scope of the relay.

The CR2791-A100A relay has a current rating of 25 amp. at 12 or 24 v. The coil operates at 1.2 watts. The single-pole, normally open contacts are designed to stay open when the coil is not energized and closed when the coil is energized at rated voltage, even when subjected to linear acceleration of ten times gravity in any direction or to the vibration conditions outlined above.

The entire relay has been built to meet United States Army Air Corps specifications. It is corrosion proof, having passed, among other rigid tests, the Navy's 200-hr. salt-spray test. Its balanced-armature construction contributes to its excellent vibration performance.

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A broad line of aircraft control devices is now available from the General Electric Company, according to an announcement by G. R. Prout, Manager of G.E.'s industrial control division. Included in the line are solenoids, relays, contactors, and pressure and limit switches, some of which are also applicable to tank and other installations.

The latest advances in metals and fabrication are being used in the design and production of aircraft control devices to assure minimum weight and size for operation at great altitudes under wide ranges of temperature and very severe vibration conditions.

In making the announcement it was said: "Increased attention is being given to making fighting craft more automatic. We are contributing to the progress being made in this field through the utilization of our already established industrial control organization, an organization which has for years engineered and produced control devices for a wide range of industrial applications."

## Gisholt Machine Company

Two new saddle-type turret lathes, to be known as the 3R and 4R, are shortly to be put into quantity production by the Gisholt Machine Company. Calculated to meet the urgent wartime requirements for this type of machine tool, the Gisholt 3R and 4R saddle-type turret lathes will be equivalent in most physical specifications to the Gisholt 3L and 4L machines. In view of their design for large-scale production, however, the machines must be built on readily available machine tools and from materials obtainable in the large quantities necessary. For this reason, also, these nearly identical machines will each be provided with the most commonly used tools and attachments. General specifications on these machines are as follows: 3R—5 1/4 in. spindle bore, 21 in. chuck, 28 1/2 in. swing over ways, 26 in. swing over carriage wing, 21 1/2 in. swing over cross slide; 4R—9 1/4 in. spindle bore, 24 in. chuck, 31 in. swing over ways, 27 1/2 in. swing over carriage wing, 24 1/2 in. swing over cross slide.

## Hall Manufacturing Company

An extensive series of tests by Hall Manufacturing Company on high-speed precision tools, covering the effect of a mixture of "dag" colloidal graphite with lubricants, has revealed some possibilities in the direction of increasing antifriction bearing and gear life, reducing wear and temperature and permitting the use of lower mechanical clearances for such mechanisms, according to R. C. Newbury, Hall Manufacturing Test Chief.

Some of the findings indicate, moreover, that the commonly assumed undesirable characteristics of conventional graphite lubricants—particularly when used with antifriction bearings—do not hold true in the case of the extremely finely divided and colloidalized electric furnace graphites. As a matter of fact, this latter type of lubricant produces results directly opposite to those that have sometimes caused graphites to be looked on with disfavor for lubrication of precision bearing assemblies.

Various tests indicated that the mixture of colloidal graphite and greases not only reduced the ball and race wear but also appeared to cause the grease to stay in the bearing three to five times as long under high-speed conditions.

As a result of these tests, it was decided to run an accelerated wear test on a typical high-speed grinder assembly. The gears in this assembly under test conditions made some 500,000 tooth contacts per minute, with one gear having double this number. Previous life tests with conventional lubricants usually had terminated at an average of around 50 hr., the accelerated-wear life of the unit in question under the test conditions.

The life test with colloidal graphite in the lubricant revealed the following results: first 500 hr., no measurable wear. At the end of this time the unit was cleaned out and replaced with plain grease. At 600 hr., no measurable wear had occurred. Shortly thereafter, the gears slowly began to show signs of wear until, at 920 hr., wear became quite rapid. At 1,000 hr., colloidal graphite was again added to the lubricant. The wear practically stopped again and it was possible to run the unit for another 1,000 hr. without appreciable wear.

According to Acheson Colloids Corporation, producers of "dag" colloidal graphite, the reason for the fact that wear did not occur between 500 and 650 hr. was the formation during the first 500 hr. of a "graphoid" surface on the gears and bearings. This type of surface, which is caused by the absorption of the extremely fine graphite particles in the surface material of the parts, not only provides a certain amount of "dry" lubrication but is effective in retaining more of the lubricant in contact with the surface, due to its increasing the wetting property of the running parts.

It is estimated by Hall Manufacturing Company that the first 1,000 hr. of operation under accelerated wear condition is equivalent to approximately 15 years of operation under actual service conditions for the unit in question.

Some of the findings are in direct contradiction to the general feeling as to graphited lubricants, particularly in the lubrication of precision antifriction bearings. However, it is believed by Newbury that graphite's disfavor heretofore had been based on attempts to use oils and greases containing powdered or flaked graphite of uncertain purity. Graphite of insufficiently minute particle size or uncolloidalized when used in antifriction bearings may form lumps in the race. Balls, traveling at high speed cannot clear these obstructions with the result of a "dent" in the race.

These characteristics apparently do not hold true for "dag" colloidal graphite as produced by Acheson Colloids Corporation. This material is extremely finely divided and does not indicate any tendency to "cake." As the result of its high affinity for oils, as well as metal surfaces, it makes possible the retention of grease in bearings under conditions where ungraphited greases are quickly thrown out.

## Lloyd S. Johnson Company

A special solder developed for the soldering of all hard-to-solder metals such as aluminum, aluminum alloys, die cast, Dowmetal, Almico, etc., has been perfected by the Lloyd S. Johnson Company of Chicago. The material is exceptionally free-flowing and provides unusual tensile strength in sheet metals and extruded aluminum. It retains color of aluminum and Dowmetal and is corrosion resistant. Solder comes conveniently rolled 1/8-in. square and

runs approximately 270 in. to the pound.

## Libbey-Owens-Ford Glass Company

Again broadening production facilities to further assist the government in its war program, the Libbey-Owens-Ford Glass Company announced that it will fabricate Plexiglas transparent plastic parts for aircraft under an agency agreement with Rohm & Haas Company, pioneer chemical manufacturers of Philadelphia.

Fabrication work to start soon will be centered in the Toledo area and, in supplementing the Rohm & Haas production facilities, should contribute substantially to the urgent need for speeding up military aircraft output.

In cooperating with the Rohm & Haas plants in Philadelphia and Los Angeles, Libbey-Owens-Ford will serve the large and expanding aircraft industry in Ohio and Michigan. R. G. Milroy, for many years manager of the company's automotive safety glass sales in Detroit, will remain there to supervise Plexiglas marketing.

In its new manufacturing and marketing arrangement, Libbey-Owens-Ford now is able to contribute more than ever before to the broad production needs of the aircraft industry and to lend technical assistance of greater scope in the use of all types of flat and bent safety glass, together with formed and flat Plexiglas plastic.

The arrangement to fabricate Plexiglas enables Libbey-Owens-Ford to return to its payrolls additional employees affected by the automotive industry's switchover to military production. The company explained that it could not accurately determine at this time how many men the new Plexiglas operations in the Toledo area will involve, but it expects to begin on a modest scale with the hope that the number of men employed will increase as the aviation industry reaches full production.

## Metal Textile Corporation

The Metal Textile Corporation has announced the production of a coolant strainer, designed to filter metal chips and cuttings remaining in suspension in the cooling system of machine tools, permitting only chip-free cooling solution to pass through the pump. Saves general wear and tear on coolant pumps and oil and production hours.

Shop practice reveals that on "dirty work" machines will operate without interruption four to six weeks. Cleaner work will permit efficient production functioning for longer periods. Refills are easily installed in a few minutes. For large coolant tanks, strainers may be "ganged" on a larger intake line.

## Mu-Switch Corporation

The Mu-Switch Corporation of Canton, Mass., announced a new Air Corps type switch designed to meet the requirements of U.S. Air Corps Specification 94-32249. The assembly consists of a basic switch with wide contact spacing mounted in a cadmium-plated steel bracket to which is rigidly attached an overtravel plunger mechanism having a pretravel of $^1/_{16}$ in. minimum and an overtravel of $^1/_8$ in. plus or minus $^1/_{32}$ in. The pressure required to operate this switch is 1 lb. minimum and 8 lbs. maximum over the entire operating range.

Electrical rating of this switch is 25 amp. at 28 v. d.c., 17 amp. at 125 v. a.c. and 8.5 amp. at 250 v. a.c. noninductive loads. Wiring connections can be supplied normally open, normally closed, and single pole, double throw. Special mounting lugs are provided on the bottom of the switch to allow the use of ring type wire connectors.

This type of construction is indicated to have some advantages over old style Air Corps type assemblies, inasmuch as the overplunger mechanism was formerly mounted directly on the bakelite switch itself. A stronger construction is now available with the mechanism directly attached to the steel bracket and, in addition, the standard switch member can easily be replaced at a very much lower cost. The characteristics and dimensions of the overtravel plunger mechanism can be changed to adapt this new switch assembly to practically any type of application.

## North American Aviation, Inc.

Successful application of a low alloy steel of the most common grade for use in military aircraft in place of aluminum alloy was announced recently by North American Aviation, Inc. Combat trainers are already using plywood structures to conserve aluminum, and steel will soon go into the assembly lines.

The low carbon, low alloy steel is somewhat similar to steel formerly used in stoves and railroad coaches—rendered more suitable for aircraft structures by means of cold reduction, which was suggested by North American after lengthy research aimed at developing a suitable aluminum alloy substitute.

Use of the new aircraft material is described by company engineers as opening revolutionary production possibilities in the face of a potentially serious shortage of aluminum alloy and high alloy steels. The steel and plywood airplanes will match or surpass present aluminum alloy airplanes in strength and safety factors.

The low alloy steel contains less than 2 per cent of strategic alloys, as contrasted with more than 25 per cent strategic alloys in stainless steel. From a war production standpoint it can be used with little change of design.

Company officials reveal that North American's advanced combat trainer—which is the standard advanced trainer for the U.S. Army, U.S. Navy, and British R.A.F.—has been adapted to utilize steel and plywood in place of 75 per cent, by weight, of the aluminum alloy parts now used in its manufacture. Wood substitutions account for 250 lbs. of aluminum alloy in each airplane, while the new steel will replace almost 1,000 lbs. of aluminum alloy per airplane.

Among parts that actual structural tests have indicated can be built with steel, North American lists wings, wing center sections, wing tips, vertical stabilizers, rudders, elevators, flaps, and ailerons.

Except for a smoother surface on wings and fuselage, the new airplanes will look much the same as their all-aluminum predecessors. The smoother surface will result from the elimination of rivets, since wood assemblies will be joined with glue and steel assemblies will be spot welded. After initial tooling costs are absorbed they will probably be cheaper, too, because spot welding is fast and relatively inexpensive.

Only disadvantage of the new materials is a 3 per cent increase in weight which results from their use, amounting to 150 lbs. on the North American AT-6A advanced trainer, but North American engineers are confident that metallurgic research will soon bring forth a low alloy steel of further improved properties that will make possible weight parity between steel and aluminum alloy structures. Design adaptations to steel will also tend to eliminate the weight increase, which incidentally has no effect on speed or safety factors of the AT-6A, since 150 lbs. is within the allowable design load.

In terms of aluminum conservation for other war needs, North American officials pointed out that it is possible to save 1,250 lbs. of aluminum alloy on each North American trainer, or 623 tons of aluminum alloy in 1,000 such trainers—enough aluminum to build 420 modern pursuit planes or 150 medium bombers.

The results of the research and structural tests by North American, which began more than a year ago, have been made available to other airplane manufacturers, company officials said. Potentially, the new materials may be applied to combat types as well as to trainers, opening new vistas for quantity production of all types if the war should extend into a resource-draining battle of production.

## United Air Lines

Two new devices for testing aircraft radio equipment have been designed and produced by United Air Lines for use in service shops along its routes, according to P. C. Sandretto, Superintendent of United's communications laboratory.

One of the devices, designed by H. N. Wilcox of the laboratory staff, is a vibration generator for testing radio equipment under conditions considerably in excess of those encountered in flight. An air-operated generating unit with an electrical frequency control is connected with a test table which can be rotated through 360 deg. for inspection of equipment during test. A means is provided for increasing or decreasing the amplitude of vibration, with a maximum intensity of 3 g's for a 100-lb. load. The frequency of vibration is constant at 30 cycles per second.

The other device, designed by E. A. Jensen, also of the laboratory staff, is a signal generator for aligning and measuring the frequencies of all radio receivers carried abroad United's Mainliners. The equipment is made for the operation of 24 crystal-controlled frequencies but can be adapted to as many as 40. It has an output ranging from one millionth of a volt to 1 v. and is capable of modulation up to 100 per cent at six different audio frequencies.

Regarding the latter device, it was said that its design had been necessitated by the steady increase in the number of frequencies being employed in aircraft radio communication and navigation. As for the vibration tester, it provides a scientific means of determining the susceptibility of a radio set's operation to vibration as contrasted with previous methods that sometimes proved inconclusive and potentially harmful to radio equipment.

## Weltronic Corporation

Developed to meet the increasing demand for power and control units for capacitor-discharge welding—particularly in the welding of aluminum for aircraft—a new unit of this type, the Weltronic "Revers-O-Charge," is announced by Weltronic Corporation.

The new Weltronic Revers-O-Charge unit, in addition to assuring high power-factor with balanced three-phase load and minimum peak k.v.a. demand, embodies numerous features said to be entirely new to the particular field and designed to simplify control, improve operation, and increase reliability and flexibility.

From an operating standpoint, the unit is simple. Near the center of the dead-front panel is mounted a voltage regulator dial, which permits controlling the charge of condensers to the voltage desired—as indicated by the voltmeter at the top of the panel. This voltage is maintained to ±2 per cent. Voltage may be raised or lowered with the condensers charged by turning this dial.

The exact number of condensers to be charged can be readily selected by means of two five-point tap switches on the panel. These switches are normally enclosed by a hinged cover interlocked with the electrical system in such a manner that the setting of the tap switches cannot be changed without automatically discharging the condenser bank through a short-circuiting mechanism.

At the bottom of the panel is an eight-point switch which permits selection of any one of eight different charging rates to suit the characteristics of the operation. Weld sequence is controlled by a sequence panel above the voltage regulator dial. A variety of sequence panels are available to provide the exact type of sequence control desired.

Electrically and mechanically, the new Revers-O-Charge feature provides a number of advantages not previously available. Among these are the elimination of all moving elements, such as reversing switches, etc., between the condensers and welding transformers, increasing reliability of operation and decreasing chance of variation of current values between different welds.

This feature also makes possible the partial recharging of the condenser by the collapse of the field of the welding transformer after each weld, since the condensers are charged in opposite directions for each weld. This enables a material reduction in line and rectifier loads and provides increased protection against line-surge at the beginning of actual charge.

The design also eliminates all but two operating relays from the capacitor discharge unit (with the exception of control relays in sequence panel, of course).

An important safety feature of the new unit is the automatic discharge of the capacitor banks by means of a contactor with a shorting bar when the power is shut off. The banks can also be discharged with a large push button on the panel of the cabinet. This button, projecting well beyond the "start" control, also acts as a safety device by preventing the accidental starting of the charge. The safety cover interlock prevents the switching of the condensers while they are either charged or being charged or discharged.

Other safety features include the dead-front panel with removable sections and a door-interlock that prevents the opening of the service doors without first engaging and discharging all condensers and a separate external charge-current limiting device, plus high secondary leakage reactance.

The cabinet itself has also been designed for compactness. It occupies a floor space of only 28 by 58 in., with a height of only 72 in. The easily removable sections make servicing practical without dismantling the entire cabinet. The cabinet is forced-draft cooled by means of a fan taking air through a filtered air inlet in one of the two large service doors.

Rating of the unit depends on the connected capacitor load. With 480 mfd. of connected capacity, the unit is capable of a maximum of 100 spot welds per minute with a sustained rate rating of 5,200 spots per hour. This drops down to a maximum of 42 spots per minute and a sustained rate of 1,200 spots per hour with 2,640 mfd. connected.

It is designed for operation on 230/460 v. three-phase and is available for either 60 or 50 cycles. (Controls operate on 110 v. through a control circuit transformer.) Units for 25 cycle operation may also be obtained at additional cost. Included in the equipment are a special delta-Y three-phase power transformer with dual voltage primary connections, three-phase full wave rectifier bank, automatic charge-reversing switch, externally adjustable voltage regulator; discharge circuit control; necessary bank of capacitors (up to 2,880 mfd. can be provided in the cabinet itself, with additional capacitors when needed in separate unit); sequencing relays; voltmeter; fusible disconnect switch, etc.

Peak current at start of charge is limited, in addition to the partial recharge of condensers, by a high secondary leakage reactance and a separate external current limiting device. Condensers cannot be discharged until the exact (±2 per cent) predetermined voltage has been reached. Condenser discharge is through ignitron tubes, eliminating mechanical contactors.

## The Whiting Corporation

Simplicity and a high degree of accessibility in building up radial engine accessory sections are features of a new Type "RA" Unit announced by the aviation department of the Whiting Corporation of Harvey, Illinois. The new unit has a ring which clamps around the rocker boxes—at the maximum diameter of the engine. Heavy rubber cushioning pads are provided to give full protection to the rocker boxes. The entire assembly may be rotated 100 degrees in either direction to provide easy accessibility to any part of the accessory section. Interchangeable rings are available to handle various sizes and makes of engines. The adjustable propeller shaft support is equipped with a bronze bearing which is free to rotate in the bearing housing and provides a means of rotating the crankshaft periodically without interfering with the assembly operation.

For the information of our readers, the following lists the Periodicals, House Organs, and other publications regularly received and reviewed.

The prices listed are for yearly subscriptions to recipients in the United States. Subscription prices to House Organs are in many cases not available but may be obtained directly from the publication offices of the periodical.

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**The A.C.C. News,** Aviation Credit Corp. of St. Louis, St. Louis Municipal Airport, Robertson, Mo.

**Aero Digest,** Aero Digest Publishing Corp., 515 Madison Ave., New York City, $5.00.

**Aeronautica,** Aeronautica, Avenida de Mayo 1370, Buenos Aires, Argentina, Pesos 4.50.

**Aeronautica Argentina,** Casilla de Correo 1897, Buenos Aires, Argentina.

**Aeronautics,** Tower House, Southampton St., London W.C.2., 27*s.*

**Aeronca Observer,** Aeronca Aircraft Co., Middletown, Ohio.

**The Aeroplane,** Temple Press, Ltd., Bowling Green Lane, London E.C.1., 48*s.*

**The Aeroplane Spotter,** Temple Press, Ltd., Bowling Green Lane, London E.C.1., 17*s.* 4*d.*

**Air Facts,** Air Facts, Inc., 30 Rockefeller Plaza, New York City, $3.00.

**Air Force Review,** Anglo American Publishing Co., Ltd., 172 John St., Toronto, Canada, $3.00.

**Air Forces News Letter,** Office Chief of the Air Corps, War Dept., Washington, D. C.

**The Air Line Mechanic,** 6240 S. Kedzie Ave., Chicago, Ill.

**The Air Line Pilot,** The Air Line Pilots Assn. International, 3145 W. 63rd St., Chicago, Ill.

**Air Mail Magazine,** A. Phillips, Newport, Mon., England, 3*s.* 6*d.*

**Air Navigation Radio Aids,** C.A.A., Dept. of Commerce, Washington, D. C.

**Air News,** Air News, 545 Fifth Ave., New York City, $1.50.

**Air Trails,** Street & Smith, 79–89 Seventh Ave., New York City, $1.75.

**Aircraft,** Aircraft, 62–74 Flinders St., Melbourne C.-1., Australia, 16*s.*

**Aircraft Engineering,** Bunhill Publications, Ltd., 12 Bloomsbury Square, London W.C.1., 26*s.*

**Aircraft Journal,** United Aircraft Corp., East Hartford, Conn.

**Aireports,** Aero Digest, 515 Madison Ave., New York City.

**Airflow,** Casey Jones School of Aeronautics, Jackson Heights, N. Y., and Newark, N. J.

**Airlanes,** Airlanes Publishing Co., 333 W. 57th St., New York City, $2.50.

**Airpost Journal,** American Air Mail Society, Albion, Pa., $2.00.

**Aluminum News Letter,** Aluminum Co. of America, Pittsburgh, Pa.

**American Aviation,** American Aviation Associates, Inc., American Bldg., 1317 F St., N.W., Washington, D. C., $3.00.

**American Aviation Daily,** American Aviation Associates, Inc., American Bldg., 1317 F St., N.W., Washington, D. C.

**American Meteorological Society Bulletin,** Milton, Mass., $3.00.

**A.O.P.A. Section,** Aircraft Owners & Pilots Assn., 1424 Walnut St., Philadelphia, Pa.

**Army Ordnance,** Army Ordnance Assn., 806 Mills Bldg., Washington, D. C., $4.50.

**A.S.T.M. Bulletin,** American Society for Testing Materials, 260 S. Broad St., Philadelphia, Pa., $1.50.

**Astronautics,** American Rocket Society, 50 Church St., New York City, $3.00.

**Automotive News,** Slocum Publishing Co., 2751 East Jefferson, Detroit, Mich., $4.00.

**Automotive War Production,** Automobile Manufacturers Assn., Detroit, Mich.

**Aviacao,** Aviacao, Avenida Rio Branco 117, Rio de Janeiro, Brazil, Rs. 40$000.

**Aviation,** McGraw-Hill Publishing Co., Inc., 330 West 42nd St., New York City, $3.00.

**Aviation News Features,** Aeronautical Chamber of Commerce of America, Inc., 30 Rockefeller Plaza, New York City.

**Aviation Progress in Los Angeles County,** Board of Supervisors of Los Angeles County, Los Angeles, Calif.

**Bakelite Review,** Bakelite Corp., 30 E. 42nd St., New York City.

**The Bee-Hive,** United Aircraft Corp., East Hartford, Conn.

**The Beech Log,** Beech Aircraft Corp., Wichita, Kan.

**Bell Laboratories Record,** Bell Telephone Laboratories, 463 West St., New York City, $2.00.

**The Bell Ringer,** Bell Aircraft Corp., 2050 Elmwood Ave., Buffalo, N. Y.

**The Blade, Bladesman,** Curtiss-Wright Corp., Propeller Div., Caldwell, N. J.

**Boeing News,** Boeing Aircraft Co., Seattle, Wash.

**Boeing School News,** Boeing School of Aeronautics, Oakland, Calif.

**Canadian Air Cadet,** Air Cadet League of Canada, 122 Wellington St., Ottawa, Canada, $1.00.

**Canadian Aviation,** McLean Publishing Co., Ltd., 481 University Ave., Toronto 2, Canada, $2.50.

**The Cessquire,** Cessna Aircraft Co., Wichita, Kan.

**Civil Aeronautical Journal,** U.S. Govt. Printing Office, Washington, D. C., $1.00.

**Colliers,** The Crowell-Collier Publishing Co., Springfield, Ohio, $2.00.

**Commercial Aviation,** Commercial Aviation, 919 Tramways Bldg., Montreal, Canada, $3.00.

**Consolidator,** Consolidated Aircraft Corp., Lindbergh Field, San Diego, Calif.

**Contact,** The Aviation Press, Inc., Air Lines Terminal, New York City, $18.

**The Cub Flyer,** Piper Aircraft Corp., Lockhaven, Pa.

**Diesel Power & Diesel Transportation,** Diesel Power, 192 Lexington Ave., New York City, $3.00.

**Dixie Air News,** Charlotte, N. C., $2.50.

**Douglas Airview,** Douglas Aircraft Co., Inc., Santa Monica, Calif.

**The Dragon,** Fafnir Bearing Co., New Britain, Conn.

**The Engineer,** 28 Essex St., Strand, London W.C.2., £3 3*s.*

**Fleetwings' Arrow,** Fleetwings, Inc., Bristol, Pa.

**Flight,** Flight Publishing Co., Dorset House, Stanford St., London E.C.1., £2 8*s.*

**Flygning,** Kungl. Svenska Aeroklubben, Sveavagen 49, Stockholm (Sweden), Kr. 10.40.

**Flying and Popular Aviation,** Ziff-Davis Publishing Co., 608 S. Dearborn St., Chicago, Ill., $2.50.

**General Aircraft News,** London Air Park, Feltham, Middlesex, England.

**The Goodyear News,** Akron, Ohio.

**Great Silver Fleet News,** Eastern Air Lines, 10 Rockefeller Plaza, New York City.

**Heat Treating and Forging,** Steel Publications, Inc., 108 Smithfield St., Pittsburgh, Pa., $2.00.

**Indian Aviation,** Indian Aviation, 13 Ezra Mansions, P.O. Box 2361, Calcutta, India, Rs. 7/8.

**Industrial and Engineering Chemistry, Industrial Edition, Chemical Abstracts,** Ohio State University, Columbus, Ohio, $4.00.

**Industrial Standardization,** American Standards Assn., 29 W. 39th St., New York City, $4.00.

**The Institute of Welding Transactions,** 2 Buckingham Palace Gardens, London S.W.1.

**The Intava World,** International Aviation Associates, Artillery House, Artillery Row, London S.W.1.

**Interavia,** S.A. d'Editions Aeronautiques Internationales, Cité 20, Geneva, Switzerland.

**The Journal of Air Law & Commerce,** Air Law Institute, 357 East Chicago Ave., Chicago, Ill., $5.00.

**Journal of Applied Mechanics,** American Society of Mechanical Engineers, 29 W. 39th St., New York City, $5.00.

**The Journal of the Aeronautical Sciences,** Institute of the Aeronautical Sciences, 1505 RCA Bldg. West, 30 Rockefeller Plaza, New York City.

**Journal of Aviation Medicine,** Aero Medical Association of the U.S., 2642 University Ave., St. Paul, Minn., $5.00.

**Journal of the Franklin Institute,** The Franklin Institute, Philadelphia, Pa., $6.00.

**The Journal of the Institute of Transport,** Institute of Transport, 15 Savoy St., Victoria Embankment, London W.C.2., 2*s.* 6*d.*

**Journal of Research of the National Bureau of Standards,** National Bureau of Standards, Washington, D. C., $3.50.

**The Journal of the Royal Aeronautical Society,** The Royal Aeronautical Society, 4 Hamilton Place, London W.1., £3 3*s.*

**Journal of Scientific Instruments,** Institute of Physics, 1 Lawther Gardens, S. Kensington, London S.W.7., 3*s.* 6*d.* copy.

**Library Bulletins of Abstracts,** The Universal Oil Products Co., Chicago, Ill.

**The Lockheed Aircraftsman,** Burbank, Calif.

**Luchtvaart,** K.N.I. Vereeniging voor Luchtvaart, Petjenongan 72, Batavia Centrum, D.E.I., Fl. 12.00.

**The Lycoming Star,** Lycoming Div. Aircraft Manufacturing Corp., Williamsport, Pa.

**The Martin Star,** The Glenn L. Martin Co., Baltimore, Md.

**Mechanical Engineering,** A.S.M.E., 29 W. 39th St., New York City, $5.00.

**Mechanical Topics,** International Nickel Co., 67 Wall St., New York City.

**Metals and Alloys,** Reinhold Publishing Co., 330 West 42nd St., New York City, $2.00.

**The Military Surgeon,** 7th and Independence Ave., Washington, D. C., $4.00.

**Model Airplane News,** Jay Publishing Corp., Mt. Morris, Ill., $2.00.

**Model Aviation,** Academy of Model Aeronautics, N.A.A., Dupont Circle, Washington, D. C.

**Modern Industries,** Magazines of Industry, 347 Madison Ave., New York City.

**Modern Plastics,** Breskin Publishing Co., 122 E. 42nd St., New York City, $5.00.

**Modern Transport,** 105/109 Strand, London W.C.2., 20*s.*

**The Monthly Honker,** Canadian Airways, Ltd., Airways Bldg., Winnipeg, Man., Canada.

**Monthly Weather Review,** U.S. Dept. of Commerce, Washington, D. C., $2.00.

**Mundo Aeronautico,** Rivadavia 968, Buenos Aires, Argentina.

**National Aeronautics,** Willard Hotel, Washington, D. C., $3.00.

**The N.A.T.A. Climb,** $1.00; **The N.A.T.A. Dispatch,** National Aviation Training Assn., 214 E. Armour Blvd., Kansas City, Mo.

**New Horizons,** Pan American Airways System, 135 E. 42nd St., New York City.

**Nickel Cast Iron News, Nickel Steel Topics, Nickelsworth,** International Nickel Co., 67 Wall St., New York City.

**North American Skyline, North American Skywriter,** North American Aviation, Inc., Inglewood, Calif.

**The Official Aviation Guide,** 685 S. Dearborn St., Chicago, Ill., $5.00.

**The Official Foreign Air Mail Guide,** Postal Digest Co., 11 W. 42nd St., New York City, $1.50.

**Papers in Physical Oceanography,** M.I.T. and Woods Hole Oceanic Institute, Cambridge and Woods Hole, Mass., price varies with each issue.

**Parks Air News,** Parks Air College, East St. Louis, Ill.

**The Plane Builder,** Aero Industries Technical Institute, 5249 West San Fernando Rd., Los Angeles, Calif.

**Popular Mechanics,** Popular Mechanics Co., 200 E. Ontario St., Chicago, Ill., $2.50.

**Popular Science Monthly,** 353 Fourth Ave., New York City, $1.50.

**Republic Aviation News,** Farmingdale, N. Y.

**Revista de la Fuerza Aerea,** Ministerio de Defensa Nacional, Santiago De Chile.

**Romania Aeriana,** Calea Floreasa No. 13. Bucharest, Roumania, 1000 lei.

**The Royal Air Force Quarterly,** Gale & Polten, Ltd., Ideal House, Argyle St., Oxford Circus, London W.1., 5*s.* 6*d.*

**Ryan Sky News,** Ryan School of Aeronautics, Lindbergh Field, San Diego, Calif.

**The Saturday Evening Post,** Curtis Publishing Co., Independence Square, Philadelphia, Pa., $2.00.

**Schweizer Aero-Revue,** Aero Club der Schweiz, Schanzenstrasse 1, Bern, Switzerland, Fr. 10.00.

**Scientific American,** Munn & Co., Inc., 24 W. 40th St., New York City, $4.00.

**The Shaft,** Summerill Tubing, Bridgeport, Pa.

**Sheet Metal Industries,** 49 Wellington St., Strand, London W.C.2., 10*s.*

**Shell Progress,** Shell Oil Co., 59 W. 50th St., New York City.

**Soaring,** The Soaring Society of America, Inc., Box 71, Elmira, N. Y., $2.00.

**S.A.E. Accelerator, S.A.E. Journal,** Society of Automotive Engineers, 29 W. 39th St., New York City, $10.

**S.B.A.C. Press Summary,** Society of British Aircraft Constructors, 32 Saville Row, London W.1.

**The Solar Blast,** Solar Aircraft Co., San Diego Calif.

**Southern Flight,** Air Review Publishing Corp., 1901 McKinney Ave., Dallas, Texas, $2.00.

**Spartan School News,** Spartan School of Aeronautics, Municipal Airport, Tulsa, Okla.

**Speed,** Western Air Express Corp., Burbank, Calif.

**The Sperry News,** Sperry Gyroscope Co., Inc., Manhattan Bridge Plaza, Brooklyn, N. Y.

**The Sportsman Pilot,** The Sportsman Pilot, Inc., 515 Madison Ave., New York City, $3.00.

**Steam Car Development and Steam Aviation,** R.H. & H.W. Bolsover, Nestling House, Sleights, Yorkshire, England, 3*s.*

**Steel Horizons,** Allegheny Ludlum Steel Corp., Pittsburgh, Pa.

**Take-Off,** North American Aviation, Inc., of Texas, Dallas, Texas.

**The Taylorcraft News,** Alliance, Ohio.

**Technical News Bulletin of the National Bureau of Standards,** U.S. Dept. of Commerce, Washington, D. C.

**Texaco Star,** Texas Company, 135 E. 42nd St., New York City.

**Trade Winds,** Wright Aeronautical Corporation, Paterson, N. J.

**Transactions of the A.S.M.E.,** A.S.M.E., 29 W. 39th St., New York City, $12.

**The T.W.A. Skyliner,** Transcontinental & Western Air, Inc., 10 Richards Rd., Kansas City, Mo.

**United Air Lines News,** United Air Lines Corp., 5959 So. Cicero Ave., Chicago, Ill.

**U.S. Air Services,** Air Service Publishing Co., Inc., Transportation Bldg., Washington, D. C., $3.00.

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**Universal Oil Products Booklets,** Chicago, Ill.

**U.S. N.A.C.A. Technical Memorandum,** N.A.C.A., Washington, D. C.

**Victory,** Division of Information, Office for Emergency Management, Washington, D. C., $0.75.

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**Waco Pilot,** The Waco Aircraft Co., Troy, Ohio.

**Washington News Letter,** National Aeronautic Assn., Willard Hotel, Washington, D. C., $2.00.

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